SCIENTIFIC AMERICAN

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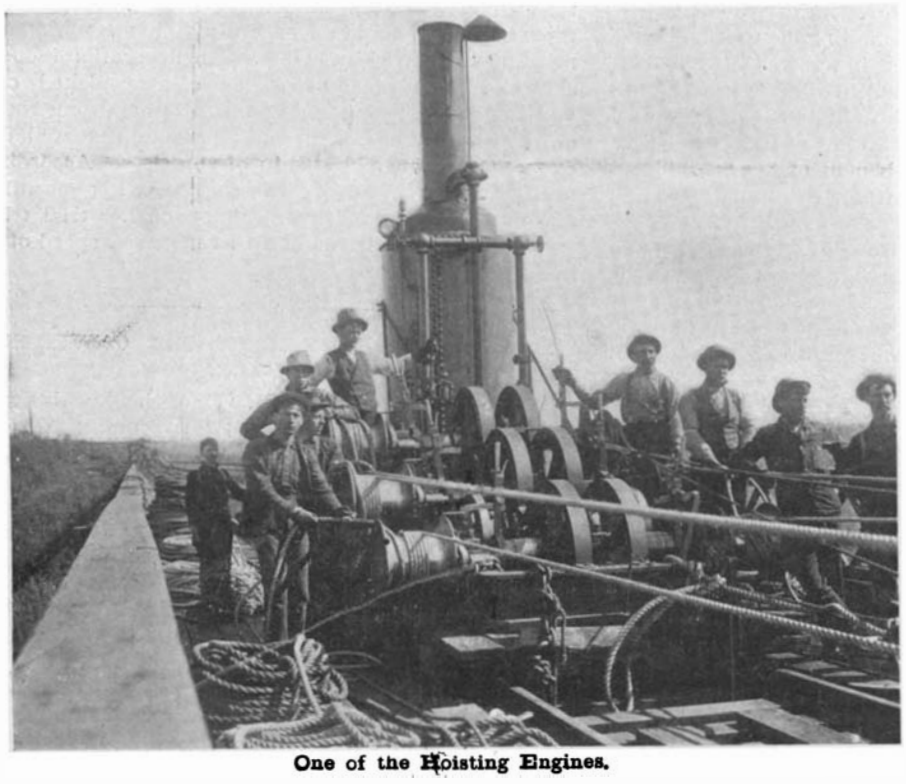
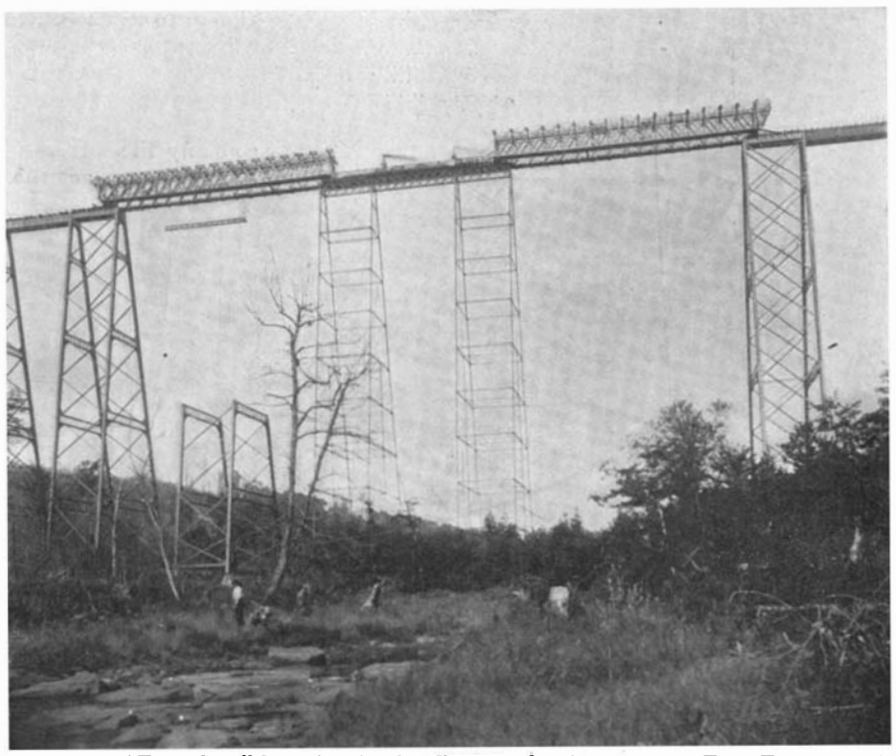


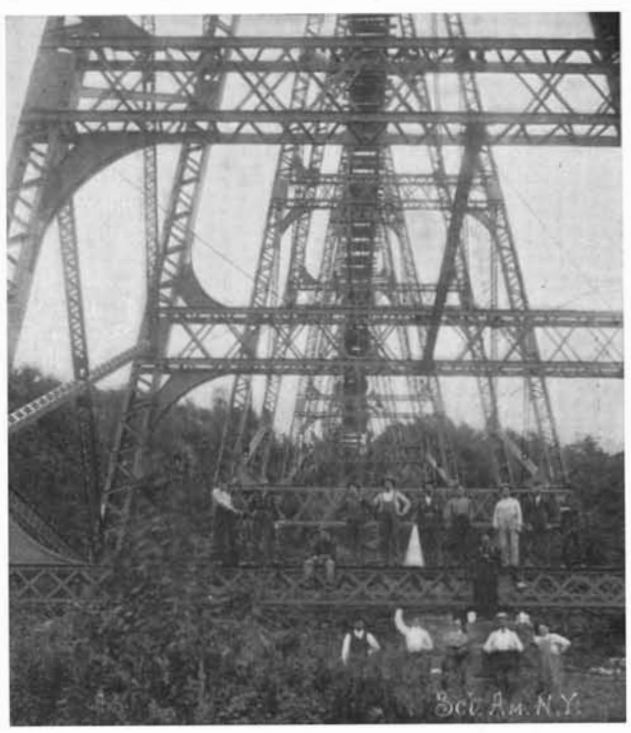
One of the Hoisting Engines.



The Two "Travelers" Meeting in the Center of Bridge. Only Two Towers and Three Spans of the Old Structure Remaining.

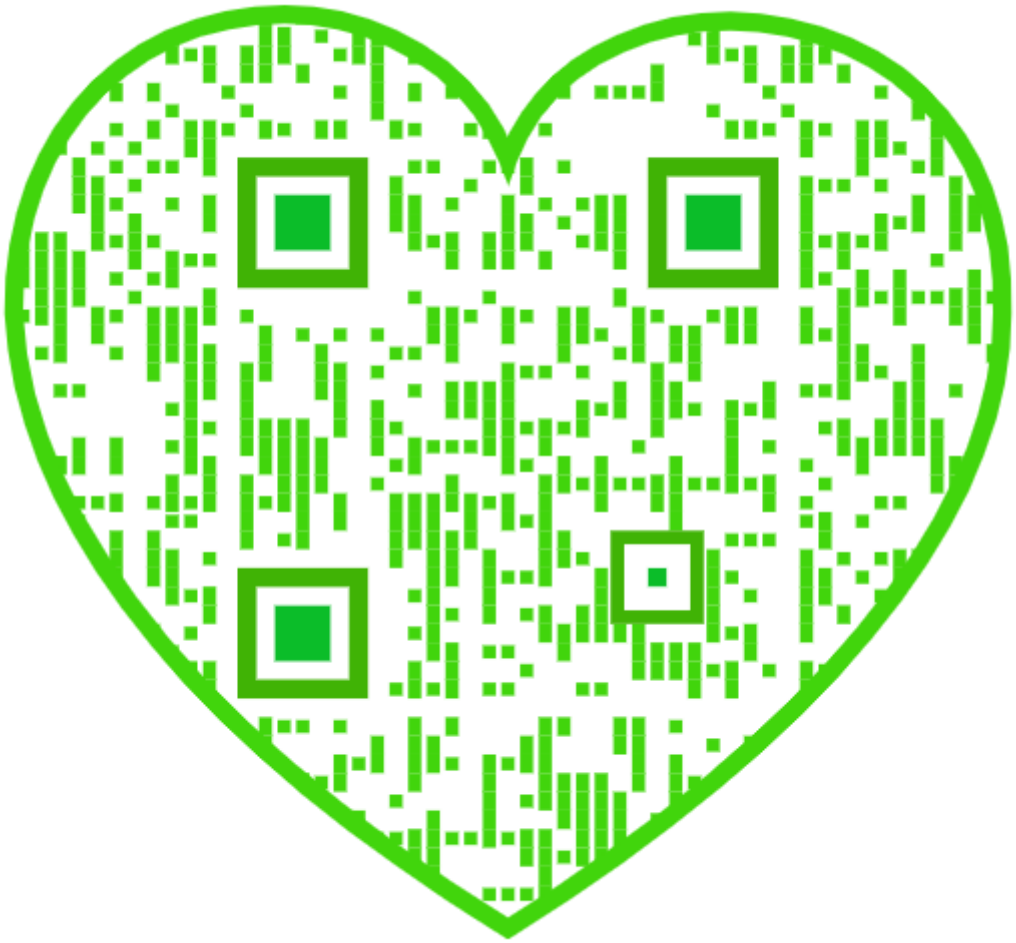
Lowering a Column Section into Position.

The Footing of a Column, Showing Knee-Bracing and Details of Construction.



View Looking through the Towers of New Bridge.

THE RECONSTRUCTION OF THE KINZUA VIADUCT.—[See page 262.]



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NEW YORK, SATURDAY, OCTOBER 27, 1900.

TO THE ARMOR-PLATE MAKERS.

It is greatly to be regretted that the armor-plate manufacturers, after obtaining from Congress such marked concessions in respect of the price to be paid for armor, should now be obstructing the work of letting contracts by an unseemly scramble to obtain a monopoly of the much-coveted orders. The amount of armor required is 35,000 tons. The bids which were made during August were of such a nature that there was no course open to the Secretary of the Navy but to reject them. The Midvale Steel Company announced that it would not accept a contract for less than 20,000 tons of armor, while the Carnegie and Bethlehem Companies each stated that they would not accept a contract for less than 18,250 tons. To have given a contract for 20,000 tons to the Midvale Company would have left only 15,000 tons to be awarded to two companies which had each refused to take less than 18,250 tons. Even if this had been done, there was a difficulty due to the fact that the Midvale Steel Company asked for twenty-six months to complete its armor plant and commence making deliveries. As the armor for the ships of the "Maine" class will be required at a comparatively early date, the acceptance of the bid of that company was out of the question.

In view of the fact that at its last session Congress had made such liberal concessions in the matter of price, it was naturally expected that after the rejection of the August bids the Carnegie and Bethlehem Companies would have arranged to put in bids for the 35,000 tons required that would have met the necessities of the case. We greatly regret to note, however, that at the last meeting between the representatives of the navy and the manufacturers, no satisfactory arrangement was reached. We should have thought that in view of the strong opposition that has developed in Congress to paying the large prices demanded by the makers, these two companies would have been moved by the dictates of prudence and common sense to show a more conciliatory and reasonable spirit. This journal has always advocated paying a fair price for armor, and has always deprecated the hostility displayed in Congress against the manufacturers; but we are free to confess that unless the Carnegie and Bethlehem Companies are prepared to meet the naval authorities in a more reasonable and less arrogant mood, they will themselves strengthen the opposition of the very party in Congress which has hitherto caused these large armor-plate establishments to stand so many months in complete or comparative idleness.

AN AMERICA CUP CONTEST IN 1901.

With a simplicity and dispatch which are delightfully refreshing after some of the long-drawn-out correspondence of former years, another challenge has been sent and accepted for the famous America cup. According to the wording of the challenge, the owner of the new vessel will be Sir Thomas J. Lipton; her name will be "Shamrock II."; she will measure 89 feet 5 inches on the water line, and she will be of cutter rig. It is more than probable that the new vessel will be designed by Mr. Watson, from whose hand came the "Thistle" and the two "Valkyries." For the defense we have the "Columbia," whose victory over "Shamrock" was by such liberal margins as to render her a decided competitor for the honor of defending the cup in the forthcoming match. To make certainty doubly sure, however, it is probable that Mr. Herreshoff will be instructed to go ahead and beat his own famous production, a task which he is sure to accomplish. The interest of the forthcoming struggle will center very largely around Mr. Watson, whose success with the German Emperor's "Meteor," and with the new yawl "Sybarita," constructed for this season's racing in English waters, renders it probable that as he did so well with yachts of the composite type, constructed of steel and wood, he will turn out an extremely fast cutter if given the same advantages in respect of materials which favored Mr. Fife, the designer of "Shamrock I." Construction in bronze or aluminium, and the substitution of hollow for wooden spars, would secure a saving of from eight to ten tons over a vessel of the "Meteor's" construction. Mr. Watson has never had an opportunity to try his hand in the new materials, and with the experience obtained in "Shamrock I." to guide him, he should be able to build a worthy competitor for Mr. Herreshoff's new defender. As Sir Thomas has expressed his intention of using the first "Shamrock" as a trial boat for the second craft of that name, the new challenger will enter the races of 1901 in the very best possible condition as to crews, sails and spars.

Recent experience in the handling of "out and out" racing machines suggests that in lightness of construction we have exceeded the margin of safety; as witness the case of "Shamrock," whose hollow spars buckled so badly in a breeze of any strength that the yacht was unable to get the full benefit of her magnificent suit of canvas, and the failure of the four Herreshoff 70-foot cutters of this season, whose hulls were so weak that their bows were pulled out of shape whenever a breeze of any strength brought a heavy strain upon the stays. It may be taken for granted that in the matter of lightness the competing yachts will start on even terms, and the race will be won on form, sail-plan, and seamanship.

ZEPPELIN'S AIRSHIP ON TRIAL.

The second trial of Count Zeppelin's colossal airship is described in press reports from Friedrichshafen as being a notable success. After rising to a height of about two thousand feet, the vessel remained poised at that level for three-quarters of an hour. It then made a series of tacks, and went through certain turning maneuvers, afterward traveling with the wind in what is described as "a generally circular direction" for about six miles, the velocity of the wind at this time being about eight miles an hour. It is said that later, in a freshening breeze, the airship turned and "made headway" against the wind. Eventually the vessel descended with "great ease and steadiness to the lake," and was towed to its shelter. The stability and steering powers of the airship are described as being excellent.

If the above reports are correct, we still know as little about the actual practical value of Count Zeppelin's machine as we did before. It has been proved merely that an airship of this kind can ascend, maintain its equilibrium, and be navigated in any desired direction, provided the wind does not much exceed the strength of a gentle breeze. It has yet to be shown that in stronger winds, say of from twenty to fifty miles an hour, this airship can perform the same evolutions. If it should show that it is able to maintain a speed of, say, only twenty miles an hour against a strong wind, aerial navigation by the balloon type of airship will have made an enormous stride in these closing days of the century. Enough has been accomplished to render the further trials of Count Zeppelin's costly and carefully thought out design a matter of world-wide interest. We publish in the current SUPPLEMENT a series of photographic views, which were taken when the airship was being put through the previous series of evolutions, which, it will be remembered, were abruptly terminated by the breakdown of part of the controlling mechanism.

THE NEW LINER "LA LORRAINE."

"La Lorraine" and her twin sister, "La Savoie," constitute the two latest and fastest steamers to be built for the Compagnie Générale Transatlantique; and the former was thrown open, for the first time, for general inspection on her recent trip to the port of New York. These two vessels were constructed under a mail contract with the French government, by which they receive a liberal subsidy if the vessels fulfill certain requirements as to construction and speed. Unlike the competing American, English and German companies, the French line are restricted in the matter of size of their ships by the limited docking facilities at the port of Havre, and in "La Lorraine" we see the largest vessel that can be accommodated under existing conditions. In these days of displacements which run up as high as 28,500 tons, "La Lorraine" with a displacement of only 15,300 tons seems to be a relatively small vessel, although her trial speed of 22·63 knots places her well up in the front rank of our fast modern vessels. "La Lorraine" is 580 feet long, 60 feet in beam, and has a molded depth of 39 feet 6 inches. She is driven by two sets of triple-expansion engines, each engine having four cylinders, placed side by side, and steam at 163 pounds pressure is supplied by sixteen cylindrical boilers.

On the trial trip, made July 24 of this year, with 89·5 revolutions of the engines per minute, a total of 22,118 horse power was developed, giving a maximum speed, as mentioned, of 22·63 knots per hour. The vessel is constructed with six decks and there are seventeen bulkheads—one longitudinal and sixteen transverse. A broadside view of "La Lorraine" shows her to be a handsome vessel, with a graceful sheer and a decided flare forward in the bows, which should give her good lifting power in a head sea. She is provided with bilge keels, and in her recent stormy passage the same marked absence of rolling was noticed which characterizes all the later ships that have been similarly fitted. The vessel is almost entirely given up to passengers, and the bulk of the accommodation is reserved for the first-class, of which 446 are carried. There is also accommodation for 116 second-class and 430 third-class passengers. The accommodation and furnishing of the vessel are fully up to the high level which has been reached in the transatlantic service. The drawing-room in particular is an exceedingly handsome apartment, measuring 36 by 69 feet. The decoration is characterized by a general toning of gray picked out with gold, and this is easily the most handsome room on the ship and one of the most pleasing that we have ever seen on a merchant ship of this class. According to literature furnished by the company, it seems that although she attained over 22 knots on her trial trip, the vessel is to be driven at an average sea speed of 20 knots an hour.

THE LOCAL FORECASTER ON THE GALVESTON HURRICANE.

The special report by I. M. Cline, the Local Forecaster of the Weather Bureau at Galveston, verifies in the main the press reports of the recent disastrous hurricane. It seems that the usual signs which herald the approach of hurricanes were wanting in this case. The "brickdust sky," which has been distinctly observed in other storms that have occurred in that section, although it was carefully watched for, failed to appear even in the slightest degree. On the fatal 8th of September, the wind did not attain a full storm velocity until about 1 P. M., after which it increased steadily until it reached a hurricane velocity at about 5 P. M.; the greatest velocity recorded for five minutes occurred at 6:15 P. M., when the wind reached 84 miles an hour, while for a short time a maximum velocity of 100 miles per hour was recorded before the anemometer blew away. It is estimated that prior to 8 P. M. the wind reached a maximum velocity of 120 miles per hour.

The barometer commenced falling during the afternoon of the 6th, and fell steadily, but slowly, up to noon on the 8th, when it stood at 29·42 inches. It then fell rapidly from noon until 8:30 P. M., when it registered 28·48 inches, a fall of about an inch in 8½ hours. On account of the rapid fall in pressure, readings were carefully taken on the mercurial barometer in order to serve as a check on the barograph, and these readings confirmed the extraordinarily low pressures recorded, and indicate the great intensity of the hurricane. Observer J. D. Blagden is mentioned as having looked after the instruments during the hurricane in a heroic manner, keeping the wires of his registering apparatus intact as long as it was possible for him to reach the roof.

Soon after 3 P. M. on the afternoon of the 8th, Forecaster Cline went from his office to his home, and at that hour found the water around his residence waist deep. At 6:30 P. M. Observer J. L. Cline went across from the office and found the water at the Forecaster's residence neck deep. An hour later there was a sudden rise of about 4 feet in as many seconds. This is estimated in the report to have made a tide of 15·2 feet. As the tide rose during the next hour, between 7:30 and 8:30, nearly 5 feet additional, the total tide in that particular part of Galveston must have been about 20 feet. "These observations," says Mr. Cline, "were carefully taken and represent to within a few tenths of the foot the true conditions." By 8 P. M. a number of houses which had drifted and lodged against the house, assisted by the force of the waves, overthrew the building, and thirty-two persons out of the fifty who had taken refuge in it on account of its strength, were hurled into eternity. Mrs. Cline was lost, and Mr. Cline and his three children were only saved after floating on the debris of the house for three hours. By 11:30 P.M., when the survivors landed, the water had fallen 4 feet. It continued to fall steadily, and by the following morning the Gulf was nearly normal.

If it were not authoritatively so stated in an official report, one would find it difficult to believe that the ocean could have risen, and continued to flow for several hours, from 10 to 15 feet above the level of the city streets. At the same time, the record of destruction for that fatal night calls for some such overwhelming agency; for, according to the estimate of the insurance inspector for Galveston, there were 3,636 houses destroyed, and the latest estimate places the loss of life at over 5,000 souls.

Although the report before us is merely an official record of the work of the station during that awful day and night, reading between the lines it can be seen that the official staff stood at the post of duty with a courage and heroism which could scarcely be excelled. The full text of the report will be found in the current issue of the SUPPLEMENT.

"THE PROGRESS OF INVENTION IN THE NINETEENTH CENTURY."

Most of the readers of the SCIENTIFIC AMERICAN are aware to what extent it has devoted itself, for more than half a century, to the chronicling of inventions and discoveries; and the publishers have thought it desirable to bring out a volume to commemorate the completion of the nineteenth century, especially as for more than fifty years this publication has given its readers, from week to week, the latest news of great scientific and engineering achievements. The new volume, which worthily celebrates the close of the century, as far as the arts and sciences are concerned, has been entitled "The Progress of Invention in the Nineteenth Century," and its author is Mr. Edward W. Byrn, A.M., who will be remembered as the successful competitor in the prize essay competition held on the fiftieth anniversary of the SCIENTIFIC AMERICAN. Mr. Byrn's book is scholarly and interesting, and records and describes all the more important developments of the useful arts which characterize the period. The influence of invention on modern life cannot be overestimated. The chapters give a very comprehensive, compact, and coherent account of the progress which distinguishes this as the "golden age of invention," resulting in an industrial and commercial development which is without precedent.

A chronological calendar of the leading inventions is one of the important features of the work, enabling the reader to ascertain at a glance the most important discoveries and inventions of any particular year. The author is specially qualified for the work by scientific training. The book cites a large number of United States and foreign master patents, thereby giving the best authority for the statements made, as they are based on official records. This has never before been accomplished, and the result is a book which will always be of sterling value as a work of reference. It will prove an addition to any library, specially to that of the inventor. Further particulars concerning the book will be found in another column.

REPORT OF REAR ADMIRAL FARQUHAR ON THE NEWPORT NAVAL MANEUVERS.

[The following extracts from Rear Admiral Farquhar's Report to the Secretary of the Navy contains all the official information which the Department, having in view the best interests of the navy, feels justified in making public regarding the recent maneuvers.—ED.]

To the Secretary of the Navy:

Sir: I have the honor to submit the following report of the combined maneuvers of the Army forces in and around Newport and officers and men of the Torpedo Station and class, the War College Staff and such members of the class as remained at the College, and the Squadron under my command. The Commanding Officer of the Training Station placed the "Vicksburg," with her officers and crew, at our disposal, as well as mounting and manning rapid-fire guns in the shore fortifications, and gave every possible assistance in carrying out the exercises. The greatest interest was shown by everyone connected with the maneuvers, and, while realizing that the time was very short and the facilities very far from complete, there was no abatement in the zeal and energy displayed. The departure of the "Kentucky," on the eve of commencing operations, necessitated a change. Captain Folger with the "Kearsarge" taking the place of Captain Chester and the "Kentucky." Lieutenant-Commander F. F. Fletcher, commanding the "Eagle," expressed a desire to participate in the exercises, and was directed to take the place of the "Bancroft."

At 2:00 P.M. Monday, September 24, the Red Squadron, consisting of the "Kearsarge," "Indiana," "Texas," "Scorpion" and "Eagle," accompanied by six torpedo boats, put to sea to establish a blockade of Newport. The remaining vessels, the "New York," "Massachusetts," "Leyden," and "Vicksburg," the last two simulating battleships, were disposed for the defense of the harbor, and arrangements were made for communication between the various forces afloat and ashore to insure active and satisfactory co-operation in defending Newport against the attack of the blockading force. The general plan followed by the Blue (inside) Squadron was to place a battleship on each side of, and just inside, the mouth of the harbor, concealed from incoming vessels, with steam up, battery trained forward, and everything ready to fire into and ram any vessel succeeding in passing the forts. One battleship, the "Vicksburg," was placed just to the southward of Gould Island. Picket boats, armed with rapid-fire guns and sharpshooters, were placed on both sides of her, four hundred yards apart. All picket boats were provided with a system of signals to warn all hands of the approach of the enemy. The "New York" was placed well inside, commanding the full length of the Main Channel, and in a position to go to any part of the field. Picket boats were placed on each side of the Eastern Passage, out of the rays of the searchlights, prepared to destroy or cripple torpedo boats, and to report their approach. A lookout signal station was also placed at Beaver Tail Lighthouse. The Eastern Passage was kept lighted by searchlights from the Torpedo Station, Fort Adams, and Fort Wetherell. The Western Passage was lighted by a powerful searchlight at Fort Greble.

The ships were cleared for action, batteries prepared and manned, and every condition of battle simulated as nearly as possible, though firing only blank charges from small rapid-fire guns. While so much was wanting, both in time and material, to carry out maneuvers on a large scale, there was no lack of zeal and enthusiasm among the men and officers engaged, and a number of very important professional points were brought out that will no doubt be of great value in the future. The army officers were particularly impressed with the value of searchlights, and they had an opportunity of seeing something of their effect when used on board vessels passing forts.

The general plan followed by all vessels was not to turn on searchlights until the approach of a torpedo boat was reported by a picket boat. The plan of placing picket boats was very successful; not a single torpedo boat got by them without being reported. With a sufficient number of searchlights on shore, it is doubtful if vessels could be piloted into a harbor at night that was at all difficult of entrance. The bow wave and wake of torpedo boats was the first object that aided in picking them up in the darkness. In this connection, I would suggest the advisability of the Department's keeping as many torpedo boats or destroyers as practicable with the squadron at all times, to accustom both officers and men with their general characteristics, movements, etc., and in order to carry on exercises with them in all the various ports visited.

The "Holland," unfortunately, in her attack upon the "Kearsarge" the second night did not reach there until after several torpedo boats did. The second night's operations consisted in an attack upon the outside, or Red, squadron by five torpedo boats and the "Holland." As a rule, the torpedo boats were successful, although this would scarcely have been the case with an efficient picket boat service.

INDIGO IN CAMBODIA.

M. Cassier, chief of the French agricultural staff at Cambodia, has recently published an interesting report relating to the cultivation of the indigo plant and the preparation of indigo in that country. The indigo plant is cultivated in all the regions of that country which are covered annually by the fertilizing deposits of the rivers. The crop is highly esteemed, and the natives estimate that the cultivation of indigo brings in three times as much as that of cotton. The fresh stalks contain 1-1000 of the merchant indigo of Europe, but the natives use only the liquid parts for the extraction, which is carried out in the following manner. The maceration tank, which is sometimes a rude native vessel, is filled with the freshly cut stalks, which are piled in horizontally to within 12 inches of the top. Upon them is placed a framework of bamboo which is held down by wedges. The vessel is then filled with water nearly to the top and the whole allowed to stand for 12 to 15 hours. The water becomes a greenish color, and the leaves become brownish. The stalks are then removed, and to the remaining liquid are added 10 to 15 pounds of lime, mixed with water to form a paste. The mixture is stirred to hasten the action, and is then allowed to stand for one hour, when the liquid becomes clear in the upper part, and is decanted off. The remainder, a thick liquid, is then put into a special tank, where the liquid from several operations is accumulated. The mass is stirred, and allowed to rest for twelve hours, when the top liquid is poured off and the remainder is drained off to the consistency of paste in a shallow vessel made of matting or of trellis-work of fine bamboo or reeds. The drying should be rapid, and it is for this reason that the vessel, which is placed on the ground, is only 8 inches deep. In two days the operation is finished, and the paste, which still contains considerable water, is packed in jars. To estimate the efficiency of this method, it may be remarked that a maceration tank holding 250 gallons and containing 200 to 220 pounds of stalks gives 33 pounds of the product sold in Cambodia, which contains only 2·3 per cent of indigotine, the remainder being made up of lime, organic matter and water.

THE SCHOOL GARDENS OF EUROPE.

More than a year ago word was sent to certain consular officers of the United States, residing abroad, to prepare a report upon the founding, progress and practical work of school gardens in their respective districts. The result of their investigations has been incorporated in a handsomely illustrated pamphlet issued by the Department of State.

The subject is a most interesting one, and Sweden, which is the home of garden schools, takes the lead and now has 2.000 of them. Great attention has also been given to the subject in France. Parliament during the Revolution had seriously studied the questions of different forms of education and of establishing courses of agricultural instruction. The hour was little propitious for the development of the peaceful arts, but within thirty or forty years, by their personal efforts alone, without government support, certain public-spirited citizens, by establishing model farms and agricultural schools, laid the foundation of agricultural teaching in France, and the Republic of 1848 passed a law incorporating the teaching of agriculture *into* the national educational system. School farms increased rapidly, and in 1852 there were seventy, the number allowed by law. From this time, however, they continued to decline until after the Franco-Prussian war, when the third Republic reorganized the entire system of agricultural education. There are 172 professors of agriculture in the primary and secondary schools, 90 professorial chairs of agriculture organized by the government, 42 agronomical stations and laboratories, besides veterinary schools, forestry schools, national agricultural schools, dairy schools, schools of practical agriculture numbering 34, schools of irrigation and drainage, schools of viticulture, horticulture, sheep-raising, silkworm culture, fruit-growing, and various stations for the study of seeds, entomology, vegetable physiology, vegetable pathology, laboratories for the study of fermentation, etc. In 1893 the government expended $828,104 for agricultural education in France. The Paris agronomical institute has 22 professorial chairs, and the course of instruction is two years. Foreigners are received under the same conditions as French scholars.

The reports from the different parts of Germany are most interesting. Germany has to fear competition from other countries in all agricultural products except fresh vegetables, and everything is being done to revive and sustain agriculture. The school gardens through the country are made a part of popular education in connection with the public schools, and whether they are merely botanical gardens to supply material for study in the schools, or agricultural gardens conducted by the children, they are more a part of the regular school routine than in the great number of schools in other countries. In Breslau there is a botanical garden of nearly 12,000 acres, and three-quarters of the ground is planted with flowers for use in school. Plants are sent at the request of the teachers, and the children are taken to see the plants growing. The scholars also receive plants to take home, and the pupils most interested receive an extra number. There is a model institution in the suburbs of Dresden where boys are taught the cultivation of all the forest and fruit trees that grow in the kingdom of Saxony, and the girls have charge of the vegetable garden, and learn to plant, hoe and weed, and all the children are instructed in the care of flowers. There is a section of the garden devoted to plants for botanical purposes. The children take great pride and interest in their work, and after the outdoor season is over, they are given bulbs and plants to take home to grow as indoor plants. The school gardens of Germany are intended more as a help to studies already in progress than as an extra course, as in the agricultural gardens of France. In Leipzig the botanical garden is of large extent, and the teachers of botany can take the children there for practical instruction, and they are allowed to take away anything they desire for study. The school board sends out a circular twice a week, giving a list of flowers in bloom, in order to encourage visits to the garden. Transplanting and grafting trees are taught by seeing the gardeners work, and the children are encouraged to cultivate little vegetable plots at home. In Munich spacious playgrounds are provided, and all new school buildings have 20 square feet for each pupil. The school grounds in the suburbs are very large and are well planned. Half of the schools have botanical gardens, and a large central garden is being started.

In Switzerland the government gives a substantial contribution for every garden which is established and also gives a yearly sum toward its maintenance. The estimated cost of these gardens is less than $500. This includes the expenses of hotbeds, summer houses, railings, fountain, plants and seeds, utensils and labor. In some cases the pupils have assisted in preparing the garden.

The following are some of the advantages of the system: The children obtain an intimate knowledge and intercourse with nature, they learn about the cultivation of fruits and vegetables. It educates boys beyond the tendency to pilfer fruits and flowers in orchards, and instills in all children a fondness for rural life.

THE destructive action on iron of free carbonic acid in water has recently been considered by Herr O. Kröhnke, whose report appeared in a German paper. The author analyzed the town's water of St. Johann, and found it to be pure and soft. The free carbonic acid amounted to 38 milligrammes per liter, and three months earlier it had been as high as 240 milligrammes per liter. This water reduced the diameter of an iron pipe from 26 millimeters to 7 millimeters in a short time, owing to the formation of a brown crust, while the pipe itself was corroded to a depth of from 1 millimeter to 3·5 millimeters. Tested in a closed vessel, this water was found to dissolve wrought iron very rapidly with formation of ferrous bicarbonate. On exposure to the air, ferric hydrate was precipitated and carbonic acid regenerated.

The Tomb of Buddha.

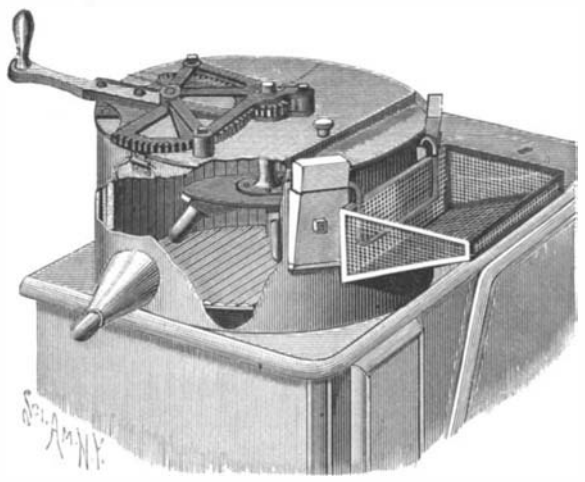
Prof. Rhys Davids has located the tomb of Buddha in the Himalayas. He found a pillar bearing an inscription written by Asoka about 253 B. C., recording the fact that the pillar marks the site of the garden where Buddha was born. It is in a region which is filled with relics and memorials of Buddha. The region is covered with small mounds which are Buddhist burial places. One of these mounds, which rises to a height of 21 feet above the plain, is 116 feet in diameter and has been excavated by Mr. W. Pepe and Prof. Davids. A number of interesting objects were discovered, including a steatite vase filled with small ornaments and beads. The tomb proper is a composition of solid brickwork. Down the center there is a curious pipe-like drain, the purpose of which is obscure. At a depth of 18 feet below the surface was found a large stone slab, which covered a stone chest in which were found three urns, a box of steatite and a crystal bowl. These objects were beautifully finished and presented all the appearance of glass. The urns contained ornaments in gold, gold beads, etc. Some of the gold leaf fragments bore figures of elephants. One of the vases is inscribed as follows: "This shrine for the relics of the Buddha, the August One, is that of the Sakyas, the brethren of the Distinguished One, in association with their sisters, and with their children and their wives." If this inscription is genuine, we undoubtedly have the burial place of a portion of the remains of Buddha, and the bones found in the vases must have been taken from the funeral pyre at the incineration of his remains. The writing points to a more remote age than that of the pillars.

"VIEUX PARIS" AT THE EXPOSITION.

Close to the footbridge which unites the Invalides and the Palaces of Horticulture and Arboriculture, there is a line of buildings and monuments 1,000 feet long, representing Old Paris. Here we find the Porte St. Michel, the Tower of the Louvre, the Grand Châtelet and the Tower of the Archbishop's Palace, and many other features equally interesting. The Middle Ages, the Renaissance and the seventeenth and eighteenth centuries are here reconstructed with the greatest historical exactness, with their curious monuments and their picturesque dwellings, their bazars and shops, all occupied by inhabitants dressed in the costumes of their period. This important restoration is the work of the well-known artist named Robida, who has done a remarkable series of books upon various sections of old France. Being situated directly upon the banks of the Seine, "Vieux Paris" has been constructed in a most picturesque manner, and is readily accessible from all parts of the Exposition. Besides its intrinsic interest, "Vieux Paris" offers a choice of attractions that have not failed to draw large audiences. Various dramatic performances are given in the hall of the palace, and in the church celebrated singers give concerts daily. There are a number of restaurants in "Vieux Paris" which round out this entertaining section of the Exposition.

AN IMPROVED CLOTHES-WASHING MACHINE.

The accompanying illustration represents a novel washing machine patented by Fridolph & Minnick, of Villisca, Iowa. The machine consists essentially of a metal tub which is provided with sleeve-brackets, in which the legs of a wringer are wedged. Sockets at the sides of the sleeve-brackets receive the hooks of a screen-tray designed to hold the clothes after they have



THE FRIDOLPH-MINNICK WASHING-MACHINE.

been passed through the wringer. The tub is designed to be placed on the top of a stove or range, for which reason its bottom is provided with slotted plates representing segments of an ordinary stove-lid, which plates enter the openings of a stove, taking the place of the usual lids and serving to hold the tub firmly in position.

Within the tub a basket is supported in such a manner that a space is left between its exterior and the bottom and interior walls of the tub. At the top of the basket a segmental cover is placed, upon which the segmental cover of the outer tub rests. The tub-cover supports an agitator consisting of interlocking cross-bars, provided at their ends with fingers. The upwardly-extending shaft is capable of end movement to accommodate itself to the clothes in the basket. At its upper end the shaft carries a pinion meshing with a segment gear provided with an operating handle.

The dirt washed from the clothes by the agitator sifts through the sides and bottom of the basket and lodges in the space below the basket. An opening is made in the side of the tub through which the water and sediment can readily flow into a suitable receptacle. The opening is normally closed by a plug.

Electric Railroads in Italy.

A number of Italian railroads are to be shortly transformed to the electric system. One of the most recent projects is that of the Naples-Castellamare line, operated by the Mediterranean Railroad Company. This line is of condsiderable importance; it is double track, and has a large traffic. The central station containing the electrical plant is to be installed near one end of the road. It will be operated at first by steam, but later on it is expected to use hydraulic power and keep the steam plant as a reserve. A high tension current will be used, and the current will be taken into the cars from a third conducting rail laid alongside of the main rails. It is expected to run an express train every two hours and an ordinary train every forty minutes; the trains will be made up of one or two cars only. The expense of the road has been estimated at $150,000 for the rolling stock and $75,000 for the station and lines. The project has already been approved by the government, and the concession of waterfall has been obtained on condition that the work shall be finished within two years.

Two other railroads which will shortly adopt the electric system are the Lecar-Sondris and the Calice-Chiavanna lines; these are about 80 miles long, and form part of the international system, being operated by the Adriatic Railroad Company. They will be operated by hydraulic power, using a fall of about 100 feet in the river Adda, near the Bridge of Desca; the company has obtained permission to take 800 cubic feet per second from this fall. A tunnel 3 miles long will bring the water to Marbegrox, where the station will be located; the power obtainable is estimated at 10,000 horse power. The central station will be operated by three turbines of 3,000 horse power, these being directly connected to three alternating current dynamos on the triphase system; the tension used will be about 15,000 volts. The regulators for the turbines will be operated by electric motors, which will vary the inlet according to the current on the line. The high tension line of 15,000 volts will follow the railroad, and will be fixed to the same posts as the trolley line; the latter will be fed from a secondary circuit, in which the tension is reduced to 3,000 volts by transformers. The latter will be contained in a series of sub-stations distributed along the line at intervals of 6 miles. The motor cars will be of two kinds; one having motors of 75 to 150 horse power for local traffic, and an express with motors of 125 to 250 horse power.

It has been found that a dozen Portuguese oysters contain about six grains of phosphoric acid; French oysters have about four grains per dozen.

"VIEUX PARIS"—SHOPS ON THE PONT AU CHANGE.

"VIEUX PARIS"—PORTE ST. MICHEL.

THE UNSCIENTIFIC CHINESE.

BY ISAAC TAYLOR HEADLAND.

The Chinese are unscientific. They lack the power of invention. They are without the creative or inventive faculty. They have a certain sort of practical

CHINESE TOP SPINNING.

common sense; indeed, they have a large amount of practical sense, which enables them to accomplish all that we are able to do, but in a very primitive fashion.

No science has ever originated and been carried to any degree of perfection in Asia. No great invention was ever made and developed by an Asiatic in Asia. No Asiatic people have ever been noted for being a

CHINESE CHILDREN EATING A MEAL WITH CHOP STICKS.

scientific people. Astronomy, which originated in Asia, was scientifically classified by the Greeks. There is no reason why these statements about the unscientific character of the Asiatics should cause the noses of Europeans and Americans to twitch in derision or pride, for there is another fact equally momentous in favor of the Asiatics, viz., no religion has ever originated and been carried to any degree of perfection outside of Asia.

This unscientific character of the Chinese could be illustrated in many different ways; but let us confine ourselves to the examination of their toys, in which only the most simple scientific principles are used. The Chinese have never gone beyond the stage where they look upon toys as merely playthings for children. Toys, however, are more than this. There is a philosophy underlying the production of toys, as old as the world and as broad as life; a philosophy which, until recent years, has been little studied and cultivated, but which, like its near relations the sciences of cooking and healing, has been driven by the stern teacher, necessity, to a self-development for the good of the race. Playthings are as necessary a constituent of childish needs as food or medicine, and contribute in a like manner to the health and development of the child. They are the tools with which he plies his toy trades; they are the instruments with which he carries on his toy professions; they are the goods he buys and sells in his toy business; the paraphernalia with which he conducts his toy society. Nay, they are more than this; they are the animals which serve him, the associates who entertain him, and his offspring from which comes no posterity.

The Chinese do not know this. They do not know that toys are Nature's first schools; that the child with his toy shovels, spades, and hoes learns his first lessons in agriculture; that with his hammer and nails he gets his first lessons in the various trades; that her mud pies and other confectionery give her her first lessons in the art of preparing food; her toy dinners and play-house teas her first lessons in entertainment; and her dolls her first lessons in the domestic relations and affections. As a consequence we need not hope to find the business of toy making or the science of child-education in a very advanced state in China. Child's play and toy making have been scientifically studied and organized into a business in Europe, as is seen in the modern kindergarten and great toy factories and children's book publications. But the toys which are manufactured in these great business establishments in Europe are still made by poor men and women in Oriental homes.

One of the best Chinese toys is the bamboo top. It is made the same, spun the same, and whistles the same as our tin top. Another, of a similar nature, but double, the two being on the two ends of a carefully turned axle, is called a K'ung Chung, and is spun by two sticks and a string. The string is wound around the axle once, and by jerking one of the sticks the top is made to spin. An old man from whom the writer purchased a dozen or more of the toys was able to spin them in a great variety of ways. Tossing it over or under his foot, or up into the air, he caught it on the string again, and would then put the sticks under his leg, behind his back, and in every conceivable position, making the top not only sing, but howl. That old man had been making those toys thirty years with a knife, saw, and sandpaper or file, but it had never occurred to him that he might invent a machine to do the work, and open a large toy factory. He made toys in the forenoon and went out to sell them in the afternoon or on market days.

The first toys to attract the attention of the child are rattles. The Chinese have a great variety of kinds made of wood or tin, gorgeously painted with a water-color, which is soon transferred from the face of the toy to the face of the child. The second style of toy to attract the attention of the child is the doll or animal. The Chinese have a great variety of this class of toys, all very crude. The nose of the doll is sewed on, its ears pasted on, and its queue stuck into its head, while its eyes and other features are painted on. They know nothing about opening and shutting their eyes, simple as that principle may be, and they have made the same mistake in their clay dolls and animals that is made by the manufacturers of our own rubber goods, viz., the same whistle that makes the dog bark, the cow low, the child cry, and the horse neigh, also makes the hen cackle, the bird whistle, and the cock crow.

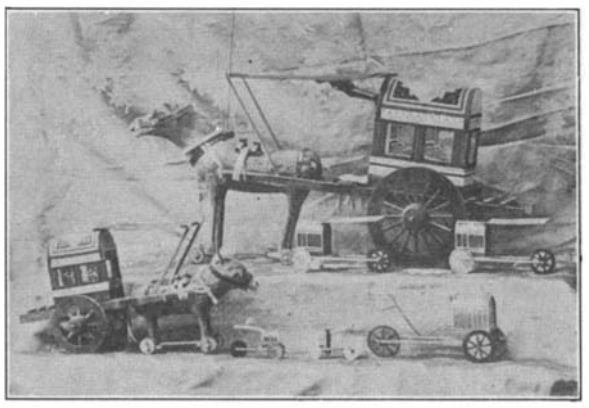
They have toy carts, but it has never occurred to them to make a self-propelling cart by a concealed spring, because, forsooth, they cannot make the spring. They have music carts which emit sounds, but not music.

They utilize, whether they understand or not, the principle of the expansion of air by heat, and construct toy lanterns with a paper wheel in the top, fastened to cross-bars, on which are hung men and women riding upon animals of all kinds, making a very interesting merry-go-round.

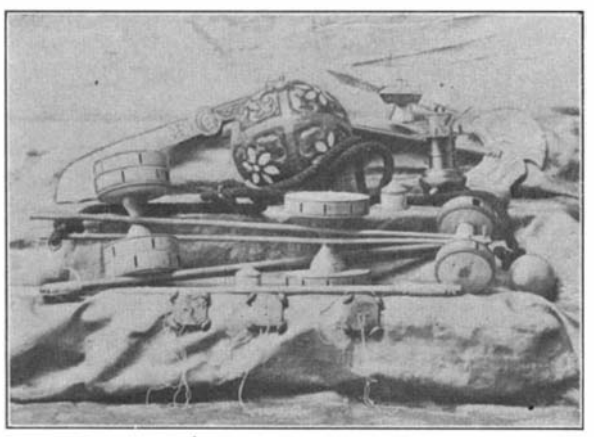
The one toy which comes nearest an indication of inventive power in the Chinese is a set of what they call the fifteen magical blocks. From these fifteen blocks they have invented more than a hundred different pictures, any of which is very difficult to make, even when you have the blocks with the picture as a pattern. It is a toy for children, but proves also to be a puzzle for grown folks.

GAS-GENERATING PLANT AT THE PARIS EXPOSITION.

In the German section at the Champ de Mars is to be seen a well-executed model showing a gas-generating installation of the most approved type, as constructed by the Chamotte-Fabrik, of Stettin. The system is designed to carry out all the operations automatically and do away with hand-labor as much as possible.



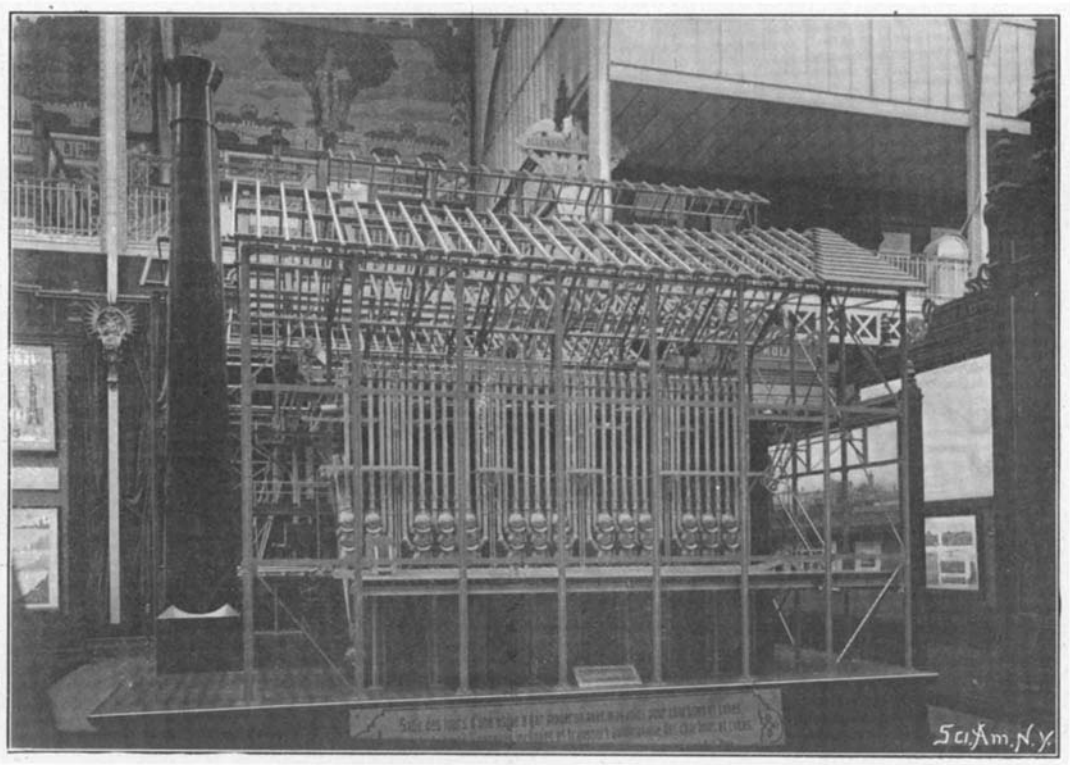
CHINESE ANIMAL AND VEHICLE TOYS.



GROUP OF CHINESE TOYS.

The model represents a furnace-room containing a battery of five furnaces, each having nine gas-retorts, with their chimney, the fifth furnace being seen in longitudinal section; also the coal magazine in the rear and the mechanical arrangements for transporting the coal, loading the retorts and carrying off the coke. A system of elevators conducts the coal as unloaded from the cars either directly to the retorts or to the coal magazine, or from the magazine to the retorts. The coke which is taken from the retorts is carried by another system of elevators to a series of reservoirs or to the coke magazine.

For transporting the coal, a well-arranged system of automatic conveyors and elevators is used. The coal, which is brought in by the cars, is discharged into a funnel-shaped reservoir; at the bottom of this is a distributor or movable plate to regulate the quantity of coal which falls into the crusher, which will be noticed in front. From the crusher the main elevator, seen at one side, takes the coal to the top, where it may be taken by a horizontal conveyor to the furnace or to the coal magazine by a traveling carriage. The latter runs upon rollers on a track placed above the coal-bins, and discharges into these, filling them equally. The coal-bins are funnel-shaped, and at the bottom is a horizontal passage by which the coal is taken from them to the furnace. A coal wagon passes along underneath, and is arranged to work automatically a series of distributors which let fall upon it the coal from the magazines. This coal wagon discharges upon a horizontal conveyor, which brings it to the elevator pit in front, and from there the main elevator takes it to the top, as in



MODEL OF GAS-GENERATING PLANT.

the previous operation, and the upper horizontal conveyor carries it to the furnace. In this manner it will be seen that the coal is taken, by an entirely automatic process, from the cars to the retorts, or to the magazine, or from the latter to the retorts.

In order to feed the retorts, a coal reservoir is placed above and back of the furnaces, to which the coal comes from the conveyor. The reservoir feeds a number of carriers which roll upon a suspended track for charging the retorts; the carriers are filled by a system of traps at the bottom of the main reservoir, operated by levers. The retorts are arranged in three horizontal rows, and there is one carrier to feed each row; when a carrier has received its contents, it is drawn in front of the retort-mouth and the coal discharged into it by working a hand lever; in this way only one workman is needed to load a battery of forty-five retorts.

Two of the retorts in the model have been made of glass, in order to show the coal in the interior. The retorts are inclined toward the front, the gas being taken from the lower end; the arrangement is known as the Coze system. This inclined arrangement allows the automatic filling and discharging of the retorts to be easily carried out. The arrangement of the furnace is such that the retorts are accessible and may be cleaned without difficulty; besides, the makers claim a complete utilization of the heat produced in the furnace and a great economy of combustible. A very high temperature is obtained in the interior of the furnace by mixing carbon monoxide with the heated air before it is sent into the furnace.

The transportation of the gas-carbon or coke from the retorts is also well provided for. After opening the upper and lower heads of the retorts, the incandescent coke falls into an automatic extinguisher and transporter called Brouwer's chain, placed in front of the furnace. This arrangement will be observed in the front view. The conveying chain moves along in front in a water-canal, and the coke, automatically extinguished, is carried to a conveyor which passes back to the coke-crusher; after being broken in the crusher the coke is raised by an elevator to a shaking-sieve, which distributes it in a series of large reservoirs placed above and back of the furnaces; the reservoirs have a trap below by which the coke is dropped into the cars; if desired, however, the elevator may take it to a horizontal conveyor which runs back to the coke-bins in the rear, and which have about the same size and arrangement as the coal-bins above mentioned; like the latter, they have a car running above them on rails, which receives the coke from the conveyor and discharges it into the bins. From these magazines the coke may be again taken to the loading-reservoir by an arrangement below similar to that used for the coal; it is discharged from the funnels into a wagon which takes it to an elevator, and it is thus lifted to the reservoir. It will be seen that the coke may be thus automatically carried from the furnace to the cars or to the magazine, or from the latter to the cars. For the motive power of the plant any of the well-known types of motors may be used; the model is driven by a small electric motor, and all the conveyors, wagons, etc., are shown in operation.

THE RECONSTRUCTION OF THE KINZUA VIADUCT.

The Kinzua viaduct on the line of the Erie Railroad has long been one of the "show" features of that picturesque route. This bridge serves to carry the railroad across a deep and comparatively narrow valley, which lies high up in the Alleghanies in the State of Pennsylvania, the floor of the bridge being approximately 2,000 feet above the level of the sea. The Kinzua viaduct is claimed to be the fourth highest bridge in the world, the loftiest being the Garabit viaduct over the Truyère, in Southern France, on which the rail level is 401 feet above the river. The new viaduct is 301 feet 6 inches above the normal level of Kinzua Creek, the measurement being taken to the base of the rails. The total length of the viaduct over all is 2,100 feet.

The new structure takes the place of an iron bridge which was erected in 1882 by Clarke, Reeves & Company, now the Phœnix Bridge Company. The old bridge was erected upon skeleton towers, and the superstructure consisted of trusses which were 38 feet 6 inches long over the towers, and 60 feet in length between the towers. The foundations consisted of masonry piers, which in every case were carried down to solid rock foundation. In the old structure were 2,500 tons of iron. Each tower consisted of two bents, the columns of which were given a batter transversely of the bridge of 1 to 6, the columns consisting of sectional, riveted, circular sections, with external longitudinal flanges, a type which has been largely used, particularly in early years, by the Phœnix Bridge Company. The towers were stiffened by means of horizontal, latticed struts, with diagonal tie-rods, and in this respect conformed to the standard practice of that day. The superstructure trusses were riveted, lattice, plate iron structures, built of plates and angle iron.

The reconstruction of the viaduct is due, not to any defects or decay in the old structure, but to the great increase which has taken place of late years in the weight of engines and rolling stock. The greater strength of the new viaduct results from the greater weight of the material used, 3,500 tons as against 2,500, from the improved materials of construction (mild steel taking the place of iron), and from the more scientific distribution of the material. The only portion of the old structure that remains is the foundations, which proved sufficient to carry the greater load imposed by the new bridge.

The principal dimensions of the old and new bridges are practically identical. The viaduct is carried upon twenty towers, each tower consisting of a pair of two-column bents. Each column consists of two built-up channel beams, the webs of which are $\frac{7}{16}$ of an inch thick and 2 feet and ½ inch in width. The channel beams are spaced 3 feet apart, and they are connected by stout latticework of steel plates and angles. Each bent is stiffened laterally by means of deep latticed struts, and the columns are further stiffened at the point of their connection to the struts by means of massive, plate-steel knee-braces, one of which is shown in the accompanying view of one of the footings of the towers. The towers are braced longitudinally by means of latticed struts and ties. All the connections are riveted, an arrangement which, as compared with the pin-and-link connection of the old structure, insures much greater rigidity. The transverse batter of 1 to 6 gives to the towers at the center of the bridge, where it is loftiest, a maximum spread of 102 feet 10¾ inches, measured from center to center at the piers. The superstructure consists of two lines of plate-girder spans, which are spaced 9 feet apart between the centers. The bents in the towers are spaced 38 feet 6 inches apart, and the spans between the twenty towers are 60 feet in length. Provision is made for expansion due to changes of temperature by interposing between one column of each bent and the foundations expansion rollers, there being a nest of these rollers, which are 3 inches in diameter and 43 inches long beneath each bent.

From a popular point of view, the most interesting feature in connection with the reconstruction of the bridge is the method adopted in removing the old bridge and building up the new structure in its place. For this purpose two "travelers," each consisting of a complete Howe truss timber bridge, 180 feet in length, were constructed and run out over the old bridge. They were built long enough to reach over three towers, say from tower one to tower three. The method of operating them was as follows: The traveler was run out over the particular tower which was to be removed, and the three spans, that is, those between the three towers and over the tower itself, were removed, and then the material of the tower was cut loose, section by section, drawn up by hoisting cables to the traveler, and run out on to the permanent structure and removed to either shore. After the old tower had been taken away, the material for the new tower was run out over the bridge to the traveler, lowered into place and riveted up. The two travelers worked from opposite ends of the bridge, and finally met in the center, as shown in one of our illustrations. The new bridge has been constructed by the Elmira Bridge Company, from plans made by Chief Engineer Buckholz, of the Erie Railroad Company. Traffic over the bridge was suspended on May 14 last. The work of reconstruction commenced May 20, and this important work has been successfully carried out in the interim by a force of from 140 to 150 men employed by the contractors, Messrs. Grattan & Jennings, of Buffalo.

Compounds of Osmium.

In a communication recently made to the Académie des Sciences, M. L. Wintrebert describes a series of experiments in which he has produced several new compounds of the metal osmium. The metal here plays the part of an acid, in combination with oxalic acid forming a series of salts, which the experimenter calls osmyloxalates; he has succeeded in producing several of these salts. The first experiment in this direction was made last year by M. Vèzes, who found that by adding an excess of oxalic acid to a potassic solution of peroxide of osmium, OsO_4, fine needle-like crystals were obtained, of a brown color, acting strongly upon polarized light. M. Wintrebert, in taking up the experiment, formed the same salt in a different manner, using the osmiate of potassium, K_2OsO_4, as a starting point. Oxalic acid is added to an alkaline and concentrated solution of the osmiate until an acid reaction is obtained and the liquid is slowly heated; it passes from a dark red to a light yellow-brown, and after cooling deposits the brown needle-like crystals previously mentioned. The conditions of the experiment indicated that the osmium is at the same degree of oxidation as in the osmiate, which is derived from the trioxide, Os_2O_3; this was confirmed by direct analysis of the compound, which gave the formula $OsO_2(C_2O_4)_2K_2,2H_2O$, it being thus an osmyloxalate of potassium hydrate.

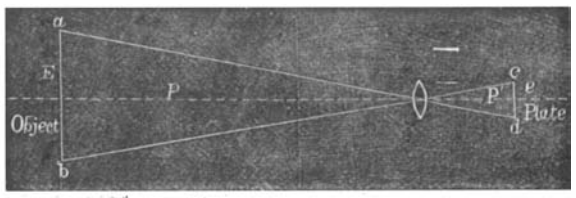
It is evident that the potassium may be replaced by other metals, and a series of salts obtained; two of these salts have been prepared, those of sodium and of mercury. The osmyloxalate of sodium is prepared by heating to the boiling point a solution of peroxide of osmium in caustic soda and adding an excess of crystallized oxalic acid, so that after this is dissolved the solution is quite acid. The boiling solution changes after a time from a dark red-brown to a light yellow-brown; it is then concentrated by evaporation. It deposits first the bin-oxalate of sodium, then the osmyloxalate appears in the form of brown crystals, which are much more soluble cold than those of the potassium salt. These two alkaline salts are but little stable in the presence of water; their solution soon becomes turbid, and a black precipitate of osmic acid is formed; this decomposition may be prevented by adding a small quantity of oxalic acid or alkaline oxalate to the solution. To prepare the silver salt, one of these solutions is poured into a solution of nitrate of silver; the brown liquid changes color, passing to a greenish brown, and deposits small greenish-brown crystals, which appear yellow by transparence, and act upon polarized light. The silver salt is rather unstable; the liquid in which it is formed often becomes turbid, and deposits osmic acid and oxalate of silver. In the crystalline state the salt undergoes a slow decomposition.

PHOTOGRAPHIC METHOD OF DETERMINING SPEED OF AUTOMOBILES.

Owing to the number of arrests which have been recently made in Paris for the fast driving of automobiles, attention has been called to a method which will determine the speed exactly, and not leave this to the judgment of the police officer. Several photographic methods have been proposed, but the only method which is entirely automatic is that proposed by M. Delamarre. The determination of the speed of a moving object depends upon the measure of the space passed over in one second; if V is this speed and E the space passed in T seconds,

$$V = \frac{E}{T}$$

Suppose an apparatus provided with a shutter and an arrangement for obtaining upon the same plate two successive images at the interval of one second, the displacement of the image would permit of measuring the space passed over.



The fundamental formula for lenses would then give, according to the diagram,

$$\frac{E}{e} = \frac{P}{p'} = \frac{p-f}{f}$$

where f is the focal length of the lens used; whence

$$E = e\frac{p-f}{f}$$

If E is known, the value of V will be at once obtained. The problem then consists in measuring E. M. Delamarre has already shown that if in operating from the same position two lenses of different focus are used, f and f_1, giving for the measure of E the values e and e_1, then

$$E = (f-f_1)\frac{e\,e_1}{e_1 f = e f_1}$$

This formula being independent of the distance at which the operation is made. It suffices then to construct a hand apparatus of the detective form with coupled shutters, whose two lenses will have different focal lengths. The operator will then make the exposure, and the plate when developed will be measured and the above formula applied, thus indicating at once the speed of the vehicle in question. An apparatus of this kind would fulfill the conditions required; it is necessary, however, before reducing the idea to practice, to overcome a number of difficulties, and the originator of the device is at present working in this direction. The difficulties, which are inherent in any apparatus of the kind, are that it is necessary to operate upon a portion of the path of the automobile which is perpendicular to the axis of the lens, and besides a lens with fixed focus must be used. It is, however, quite possible to construct an instrument of this kind of an entirely practical nature.

Sneeze-Wood.

Among its many peculiarities, South Africa includes the "sneeze-wood" tree, which takes its name from the fact that one cannot cut it with a saw without sneezing, as the fine dust has exactly the effect of snuff. Even in planing the wood it will sometimes cause sneezing. No insect, worm, or barnacle will touch it. It is very bitter to the taste, and its specific gravity is heavier than water. The color is light-brown, the grain very close and hard. It is a nice-looking wood, and takes a good polish. For dock work, piers, or jetties it is a useful timber, lasting a long while under water.—The Building News.

Science Notes.

According to The Medical Record, a young woman in a town near Philadelphia was recently burned about the head from the combustion of a celluloid comb worn in her hair. Burning joss sticks were stuck in the hair for the purpose of keeping away mosquitoes, and this resulted in the combustion of the comb.

German agriculturists have expressed a desire to have established a meteorological signal service, and the government is inclined to comply. A meeting of the government officials and meteorological and agricultural authorities is soon to take place at Hamburg to discuss the introduction of a telegraphic service for German agriculture.

Prices of fine woods have recently advanced from 15 per cent to 35 per cent. This is caused by an increased demand for veneers for making furniture, piano cases, musical instruments, etc. The new method of decorating walls with veneers instead of tapestry or wall paper and leather has also resulted in a great increase in the demand for fancy woods.

An attempt will soon be made by Californian merchants to put fresh asparagus on the market in London and other places in Great Britain. The California navel oranges are growing in favor in England and are being much appreciated. It is expected that California asparagus will compete with French asparagus, which is sent to England in large quantities. Great Britain is now importing considerable quantities of prunes from California.

Detailed study of the different vowels and consonants and the corresponding currents and counter-currents of air has induced M. Gellé to conclude that the intra-buccal column of air is not inert, and that the buccal cavity does not act as a resonator, as it is usually said to do. It is the air itself, by its alternate condensations and dilatations, which result from the action between the currents, and produce the subvowels along with the laryngeal sound.

The Remington Standard typewriter has received a Grand Prix at the Paris Exposition, which is the highest form of award, outranking all medals. The same machine received a gold medal in 1878 and also one in 1889, so this is the third time that they have taken the highest possible form of award at a Paris Exposition. The Bristol Company, of Waterbury, Conn., manufacturers of recording instruments, steel belt lacing, etc., received a silver medal at the Paris Exposition for their recording instruments.

Permits are not now required by the Department of Agriculture for the importation of certain animals. This includes: Mammals—Anteaters, armadillos, bears, chimpanzees, elephants, hippopotamuses, hyenas, jaguars, kangaroos, leopards, lions, lynxes, manatees, monkeys, ocelots, orang-utans, panthers, raccoons, rhinoceroses, sea-lions, seals, sloths, tapirs, tigers or wildcats. Birds—Swans, wild doves, or wild pigeons of any kind. Reptiles—Alligators, lizards, snakes, tortoises, or other reptiles. Canaries, parrots, and domesticated birds, including pigeons, are subject to entry without permits, but with the exception of these species, and those mentioned above, special permits will be required for all live animials and birds imported from abroad.

F. Larroque has recently made some interesting observations of the mechanism of hearing. He studies the action upon the ear of sounds produced by the bowing of a string stretched by a vessel containing water which slowly flows away and thus releases the tension very gradually. He finds that when the sound is conveyed to the two ears through hearing-tubes, two distinct impressions are created, and there is no interference whatever by the phase of the two sound-waves. This shows that the auditory apparatus of any one ear acts independently of the other. The author discovered a peculiar break of continuity in his right ear, amounting to $\frac{2}{19}$ of a semitone between mi_3 and fa_3. He thinks that some of the Corti fibers have been accidentally broken, and looks forward to future microscopic verification of his supposition.

On September 22 last Mr. Zekeley, of Berlin, in company with Dr. Berson, of the Royal Berlin Meteorological Institute at Berlin, Mr. Alexander, of London, Dr. Süring, of the Meteorological Institute at Potsdam, made an ascent in a balloon from the Friedenau Sport Park near Berlin. Their object was to ascertain exactly how long a balloon can remain in the air. The balloon had a capacity of 90,000 cubic feet of gas, and it was inflated under the direction of two officers of the German army assisted by soldiers of the military ballooning section. The balloon rose rapidly, and in about ten minutes had completely disappeared from sight. It was expected that the balloon would remain in the air for several days, and with this end in view the voyagers had observed the precaution of carrying sufficient provisions for several weeks, while they were also supplied with maps in case they landed on some inhospitable island in the north of Europe. Unfortunately, however, the balloon, owing to the lack of wind, descended a few hours after the ascent, having traveled only a few miles.

Engineering Notes.

It has been suggested that calcium carbide be used as a deoxidant in foundry practice, the reagent being added to the metal before pouring. It is stated that aluminium bronze can be produced by highly heating a mixture of alumina and copper chloride in contact with the calcium carbide.

The steamer "Paris," which went aground last year, is being rebuilt at Belfast, and will be known as the "Philadelphia." The vessel is receiving an entirely new bottom, and new boilers and engines will be put in. She will have two funnels instead of three, but will otherwise preserve her former appearance.

At the Paris Exposition there is on view a large diving bell, 138 feet in length, 46 feet in width, with a working space height of 8 feet. It is being utilized in connection with the new dry docks at Kiel for the German navy. The fittings of this diving bell comprise a suspension frame supported by two barges, two air chambers for the workmen, one of which is set apart for the concreting, and two fitted with electric lifts for the supply of materials to the workmen. Two large electric cranes serve for the bulk transportation of the materials; while the concrete is prepared by two electric mixers with a capacity of 523 cubic yards per hour. It is expected that the docks will be completed by 1903.

During the early stages of the Boer war, the English War Office was bitterly censured for its backwardness regarding arming the troops, and also in connection with the mounting of the coast defenses with obsolete muzzle-loading guns. The Defense Committee of the Cabinet have recently placed orders to the extent of $29,035,000 for modern guns for coast defenses, thus bringing up the expenditure during the last few months for this purpose alone to $35,000,000. The arsenals at Woolwich and at several other armament factories are working at full capacity for the delivery of government orders. When the war is concluded, there is no doubt that the whole artillery of the British army will be carefully overhauled, and the most powerful guns substituted in the place of those which have become obsolete.

The French government has just mounted a huge Creusot gun at Calais as a set-off to the enormous harbor works that are in progress for the British Admiralty at Dover. It is said that the new gun has a range of twenty miles; and as the Straits of Dover at this point are only eighteen miles in width, the gun will, if it proves satisfactory, be able to drop its projectiles upon British soil. The English government have mounted some exceptionally powerful ordnance at Dover within the last month or two. Several guns that have been placed upon the forts there have a range varying from fifteen miles to eighteen miles, so that Dover practically sweeps the Channel at this point. Great activity is at present being displayed all along the south coast. New, heavier, and modern ordnance is rapidly supplanting the obsolete muzzle-loading weapons, while several new batteries are being constructed.

Lieut.-Colonel Lemchen, of the Swedish army, and director of the shooting school at Rosenberg in Sweden, has invented a new rifle. Its most distinguishing feature is the automatic placing of the cartridge in the firing chamber. The small arm is similar in every respect to the Mauser and carries the same cartridge. The soldier when using the rifle fills the magazine with the cartridges and fires. Directly the rifle has been discharged, instead of the soldier having to withdraw the empty cartridge to place the next cartridge in position by a sudden movement of the breech, it is done automatically. By this means the soldier has nothing to do but to continue discharging his rifle until he has emptied the magazine. The rifle is extremely simple, both in design and operation, and what is more important, the shock of recoil is reduced to a minimum, since this shock is utilized to place the next cartridge in the firing chamber.

Compressed air motors, in lieu of horse traction, are to be employed for the propulsion of the vehicles belonging to the Compagnie Générale des Omnibus of Paris. The station for accommodating the necessary compressing plant is to be erected at Billancourt. The plant will develop from 5 000 to 7,000 horse power, and the air will be stored in the main receivers at a pressure of 1,400 pounds to the square inch. From these receivers the compressed air will be conveyed to the distributing stations in weldless steel pipes from two inches to four inches in diameter, laid along the roadway. In order to reduce the possibility of extensive leakage, through imperfect joints, the pipes have been manufactured in 64-foot lengths. Each car carries eight receivers with a total capacity of 88·27 cubic feet, which is estimated to be sufficient to enable the car to run a journey of 7½ miles without recharging, and they can be recharged in three minutes. Before the air passes into the motor cylinders it is heated by means of a small coke fire. Fifty-two passengers form the complement of two cars, accommodated upon two decks.

Electrical Notes.

The New Haven and Derby Railroad will be equipped with electricity during the coming year, and a start will be made toward building an extensive railroad system connecting New Haven, Derby, and Bridgeport. A 3,000 horse power plant is being erected at New Haven. It is said that this step is being taken with a view to head off the danger of paralleling by an ordinary trolley road.

The Marconi installation between the Mumbles lighthouse, off the coast of Glamorganshire, has just been completed and will soon be in operation. The distance over which the messages will be transmitted is twenty-five miles. The Chilean government have also just placed an order with the Wireless Telegraph and Signal Company for an installation of the Marconi system between Punta Arenas and Ancud or Puerto Montt.

The whole system of modern chemistry is based upon the axiom of the indestructibility of matter, and that indestructibility is proved by the permanence of the weight of a given substance through all the physical or chemical changes it is made to undergo. Any experiments, therefore, which shake our belief in that primary property of matter must have a far-reaching effect. Landolt's classical researches in 1893 embodied the first work done with all the modern instruments of precision. Certain minute changes of weight were then placed in evidence, and these have since been confirmed. A. Heydweiller has endeavored to trace some connection between the change of weight and the changes in other physical properties, such as magnetic permeability, electrolytic dissociation, and material or optical density. He has failed to trace any such connection, though he has distinctly established a diminution of weight of about 1 part in 50 million in a number of reactions, such as the mixture of copper sulphate with water, where a loss of weight of 1 milligramme was observed. Researches such as these take place in the extreme borderland of science, but the logical outcome of the results would be nothing less than the destruction of matter.—A. Heydweiller in the Physikalische Zeitschrift.

The first electric railroad in which the triphase alternating current system has been used in Germany has been recently installed between Oberammergau and the town of Murnau, its total length being about fifteen miles. The road, starting from the latter station, is comparatively level for the first few miles, but further on a three per cent grade is reached, extending over four or five miles. The highest point of the line is between Saulgrub and Altenau, which is 2,500 feet above sea level and 438 above the starting point. The line ends at Oberammergau; the terminal station is not far from the theater in which the Passion Play is represented. Hydraulic power is used to operate the road, a fall in the Ammer River being utilized. The station is located at Kammerl, about 10 miles from Murnau; the fall gives 1,000 to 1,500 horse power. A dam has been constructed across the river, and the water is brought to the station by a canal 1,500 feet long, terminating in sheet iron tubes of large diameter. Three turbines of 500 horse power each are used to operate the alternating current generators. For the road the trolley system is used, with overhead line. The road has been planned so that steam engines may be used; this will be necessary to provide for the great traffic at the time of the Passion Play, which occurs every ten years. During these periods the road will be operated by steam, and connection will be made with the main railroads, so that the international express trains may be run. At ordinary times the road will use the electric system.

An interesting utilization of wireless telegraphy is recorded in connection with the ice-breaking steamer "Ermak" during last winter. The Russian ironclad "Generale Amiral d'Apraxine" ran on the rocks fringing the coast of the island of Hohland, in the Gulf of Finland. It was necessary to save the vessel, and to accomplish this it was desired to establish communication by some means or other with the mainland and with the "Ermak." A high mast supporting a wire was erected upon a high point on the island of Hohland, and the necessary transmitter and coherer installed, while a similar plant was stationed on another island 33 miles away, the instruments in both cases being supplied from the warship, which was equipped with the apparatus. The vertical wires utilized, 157 feet in height, and the sparks from the induction coils were 14 inches long. The installation worked without the slightest hitch over this great distance. On one occasion it was successful in the rescue of 27 fishermen who were carried away on an ice floe. The perilous position of the fishermen was transmitted from one station to the other, thence to the "Ermak," from which vessel a boat put off and so effected the timely rescue of the unfortunate fishermen. The apparatus was in operation for 84 days, and was only suspended on two occasions, owing to severe snow storms. In all, 440 official messages were dispatched between the two stations, with complete success. Curiously enough, the apparatus was found to work better during the prevalence of storms than in calm weather.

THE ELECTRIC FIRE AUTOMOBILES OF THE PARIS FIRE DEPARTMENT.

A few weeks ago, the firemen of Paris drilled at Vincennes in the presence of their provincial and foreign colleagues who had assembled on the occasion of the International Congress. In this drill improved apparatus was used, which has been recently introduced for the purpose of enabling the firemen to reach and extinguish fires more rapidly than heretofore. It will be understood, in fact, that upon such rapidity depends the real efficiency of a fire service, and there is no need of dwelling upon the great advantages that result therefrom, since a few minutes gained in the attack may very often prevent a fire of slight consequence from assuming the proportions of a catastrophe. Continuing its improvements in this direction, it was but natural that the Paris fire department should invoke the aid of electricity. Three new types of fire automobiles have been constructed, which were used at Vincennes on the occasion above mentioned. The vehicles included a hose wagon, a fire engine, and a hook and ladder.

The hose wagon, of which Fig. 3 represents the most recent type, is already well known to Parisians, who have seen it in operation for several months past. This sort of vehicle is nothing more than an electric automobile capable of seating six men and provided with a supply of hose, nozzles, ladders, and life-saving apparatus.

The electric fire pump, which is of an entirely new type, consists in principle of a metallic tank of 100 gallons capacity mounted upon an automobile carriage, and a pump provided with a hose and nozzle. The same electric motor which propels the carriage drives the pump as soon as the vehicle comes to a standstill at a fire. To this effect, a very ingenious system of gearing transmits the power of the motor to the propelling mechanism of the pump, and inversely. This system, therefore, constitutes a complete combination for immediate operation. It offers the advantage of permitting the vehicle to start without any delay as soon as an alarm is given, and of allowing the engine to be set immediately in operation as soon as the vehicle reaches the fire. In order to maximize such rapidity of action, no detail should be neglected. It is for this reason that in the stations that are to be provided with this engine (and all will be within as short a time as possible), its crew will consist of three, or even of two men, since that number fully suffices for the operation of the engine.

Again, it is with the same object of rapidity of action in view that the hose of the engine reel consists of a rubber tube provided internally with a spiral of metal, which preserves its cylindrical form and permits it to be kept full of water, even when it is wound up. In this way, when the engine is ready for action, it suffices, in order to obtain a stream of water, to open the cock of the nozzle without the necessity of unwinding the hose entirely or of waiting for it to fill.

The engine, therefore, starts off at the first alarm, and, as soon as it reaches the fire, commences to act in utilizing the 100 gallons of water in its tank, which under ordinary circumstances suffice for an operation of five or six minutes.

During this period, the electric hose wagon, which immediately follows it, has had time to arrive in its turn and allow the hose that it carries to be coupled to a hydrant in order to supply the engine. Then, if the extent of the fire requires it, the attack is pursued as usual with steam and hand engines ; but, in all cases, valuable time has been gained by the preliminary and immediate action of the electric fire engine.

The engine, in running order, weighs, inclusive of the crew and 100 gallons of water, 6,380 pounds. As shown in Fig. 2, the pump, properly so called, has three chambers. It forces the water, through the axis of the reel, into the rubber hose, which carries a nozzle provided with three screw orifices of different diameters, by means of which it is possible at will to vary the discharge and pressure according as the engine is operating with its own resources or is being supplied with water from any other source. It is thus possible, for example, to discharge 20 gallons a minute with a ¼-inch orifice and a pressure of 4 atmospheres, and 50 gallons with a $\frac{4}{10}$-inch orifice and a pressure of 7 atmospheres. In addition, the engine carries a suction pipe that permits it, when there is no hydrant at hand, to draw water from a depth of 23 feet.

Finally, the engine, as well as the hose wagon, is arranged in such a way as to permit the utilization of a part of the energy of the accumulators for the illumination, through arc or incandescent lamps, of fires that occur at night. This latter system will prove particularly valuable in cases where it is necessary to throw light into places in which the existence of explosive mixture may be suspected. This collection of apparatus is completed by the electric ladder. This consists of a low truck upon which the large ladder in use in the department is hoisted almost horizontally by means of an inclined plane and a windlass. The total weight of this apparatus, inclusive of its crew, is 9,150 pounds. It is the heaviest of the pieces of fire material to which mechanical propulsion has been applied. So, by reason of the peculiar difficulties presented by the maneuvering of it, it became necessary to assure the perfect stability of the vehicle, especially in turning corners, while running at considerable speed. This has been done so successfully that the electric ladder truck is more stable than horse-drawn ones.

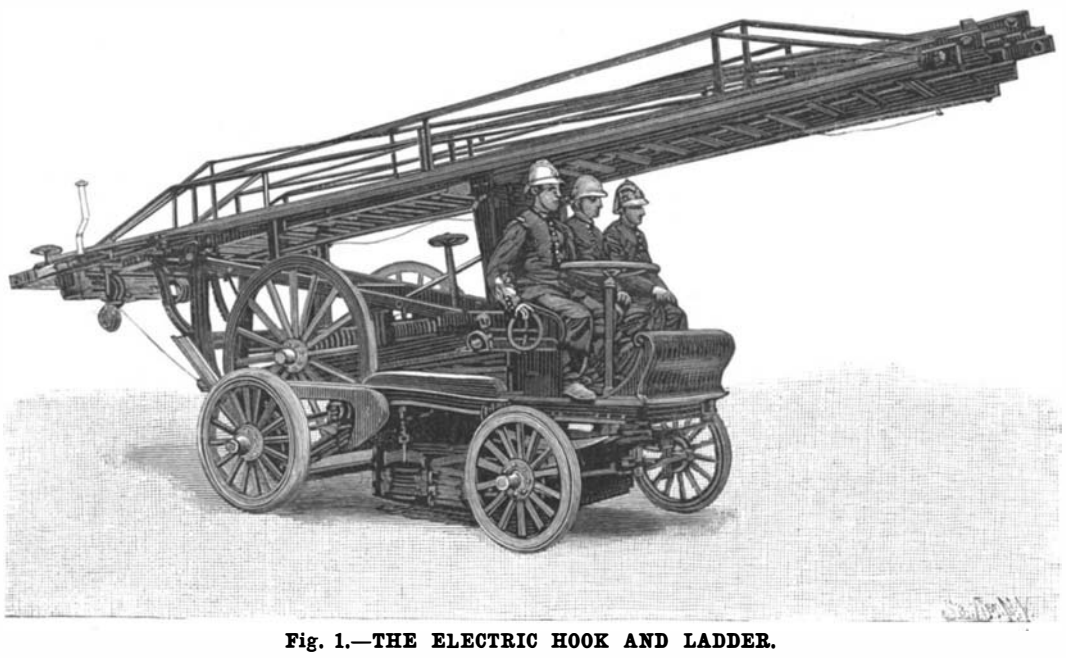


Fig. 1.—THE ELECTRIC HOOK AND LADDER.

The electric energy necessary for the operation of the three apparatus is furnished by batteries of accumulators of the Société Bouquet-Garcin-Schrive, of Neuilly, inclosed in a case suspended beneath the vehicle. These are so calculated as to permit of making 36 miles at an average speed of 12 miles an hour without being discharged.

Let us note, in conclusion, that the staff of the department, well satisfied with the first results obtained with these new apparatus, is desirous of successively applying automobile propulsion to its entire material.

We are indebted to L'Illustration for the above information.

THERE is only one sudden death among women to eight among men.

Interesting Experiments with Torpedoes.

Some elaborate experiments to test the explosive force of torpedoes have recently been carried out on an uninhabited island in the Trans Sound, an inlet of the Gulf of Finland. The officials in charge of the trials erected a galvanized hut. In this they placed a torpedo tube charged with a Whitehead torpedo, the nose of which projected from the tube, as it would if placed on board ship in time of war. The idea of this particular test was to ascertain what would occur if a shot was to penetrate the torpedo tube on board a battleship while charged with a torpedo. With a view also of obtaining some idea of what effect such an explosion would have on the members of the crew, a number of sheep was permitted to graze in the vicinity of the hut. The air in the air chamber of the tube was compressed to eighty atmospheres. The shot, fired from a safe distance, penetrated the wall of the hut and entered the air chamber of the tube. No explosion resulted, but the imprisoned air rushed through the hole caused by the bullet with a terrific noise, but no damage was caused. The next experiment was to explode 187 pounds of gun-cotton inside the hut near the head of the torpedo protruding from the tube. The explosion was effected by means of a twenty minutes' time-fuse, so that the officials might have sufficient opportunity to get away from the spot. Some of the officers took up positions upon a small neighboring island. The sheep, as before, were grazing around the hut. The gun-cotton exploded with a terrific report, and no doubt also fired the charge within the torpedo, since the tube shed and the sheep near were blown to pieces.

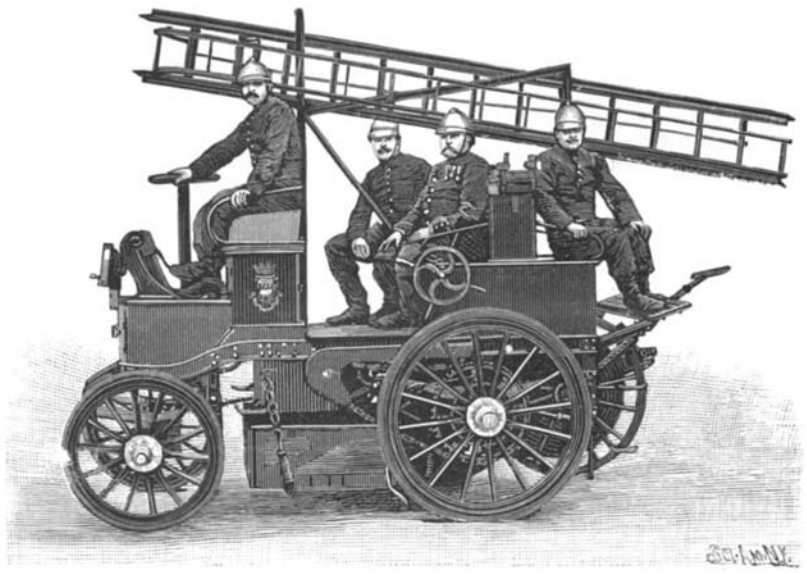


Fig. 3.—ELECTRIC HOSE CART.

Strange to say, a sheep seventy-five yards from the hut was absolutely uninjured, thus proving that the force of the explosion was local. The officers who watched the operations from the neighboring island experienced a severe concussion of air. The officials now procured a pontoon which they had covered upon the bottom surface with four thicknesses of armor plate. This was placed in shallow water and a torpedo was fired from a tube so as to strike the protected bottom of the pontoon. The result of the impact was that the pontoon was blown into the air.

Fig. 2.—ELECTRIC FIRE-PUMP UNDER WAY.

RAILBREAKER FOR REMOVING OLD TRACKS.

BY GEORGE STARK.

The St. Louis Transportation Company is at present making extensive improvements in its roadbed, and among other things is converting the Broadway cable into an electric line. The old tracks are being torn up, and with a view to enabling the company to make use of wider and larger cars, the new tracks will be placed somewhat further apart than the old ones. In removing the old track, the company is making use of a device known as the "railbreaker." This massive, powerful machine is the invention of George W. Barumhoff, General Manager, and Otto Schmidt, Master Mechanic of the Traction Company, and it is decidedly interesting to watch the ease and rapidity with which the machine tears up the old rails and at the same time breaks them into suitable lengths for scrap.

The railbreaker consists of a platform carried on two trucks and is propelled by a 15 horse power electric motor. At the forward end of the platform is erected a pair of stout, upright timbers, each of which carries a sheave at its top. The lowerends of the uprights are shod with steel and extend down close to the top of the rail. A heavy chain is provided with massive grippers at its outer end, and is carried up over the sheave and leads down to a drum on the platform, which is driven through intermediary gearing by an electric motor. When the railbreaker is in operation, it is run to the end of the track until the steel-shod bases of the two uprights rest upon the track at the point at which the rails are to be broken. The grippers are then carried forward and clamped at the ends of the rails, and under the pull of the chains the rail is bent up and broken at the heels of the posts, as shown in the accompanying engraving. The machine is capable of breaking the heaviest make of girder rail to any length that may be desired. The old rail when broken up in short pieces is not only easier to handle, but will bring about a dollar per ton more for scrap than a rail in thirty-foot lengths. This machine in one working day is capable of tearing up several thousand feet of track with the corresponding economy of time and labor. Such is the strength of the machine, that the rail is torn bodily away from the ties and up through the paving blocks, no preliminary loosening of the surface being necessary. In the present case the iron is being broken into lengths of about five feet, and as it is broken it is left lying on the ground, to be gathered up by the laborers and taken to the scrap pile.

FRONT VIEW, SHOWING TWO LENGTHS OF RAIL PULLED LOOSE AND BROKEN.

The Exportation of American Street Cars.

Before the introduction of electricity upon street railways, American builders exported horse cars to every quarter of the earth. England, France, Italy, Australia, India, the Philippines, and New Zealand, as well as the east and west coasts of South America, used American street cars. Having been far ahead of the world in the introduction of electric street railways, America has largely supplied the electric roads of foreign countries with not only engines and electric machinery, but street cars as well. The J. G. Brill Company, of Philadelphia, during the year 1899 built and sent abroad about three hundred trolley cars, besides a large number of cars of a miscellaneous character. The destinations have been in a general way England, the Continent of Europe, Africa, South America, and Australia.

A considerable order for cars came from Monte Carlo. These were particularly interesting to an American on account of the narrowness of the body, which was little more than six feet inside, and the fact that though the cars were so small, they were divided into first and second class compartments. The first-class compartment had cross seats, with an aisle on one side of the center, the seats holding one and two persons respectively. The first-class compartment was very elegantly upholstered and finished, while the second-class passengers had to be content with the plainest woodwork and seats. A shipment was also made to Lyons, France, of cars quite similar in appearance.

A large number of double-decked cars of a peculiar type were sent to South Africa. They were distributed between Cape Town, Port Elizabeth, and Durban. Many of these cars had barely six feet head-room in the center. Several lots of double-deck cars of the same general type have been sent to France. In these the upper deck was even more restricted in head-room than those for South Africa. All of these cars were erected and finished complete. They were then taken apart and packed flat in boxes, like a pack of cards. In some cases the painting and varnishing were omitted, leaving the cars in what is technically known as "in the white;" that is, they have merely a priming coat to protect the woodwork from dampness. When shipped in this way, the glass and upholstery are omitted, and the sections can be stowed so compactly as to make the saving of perhaps 10 or 20 per cent in the bulk of the car. This system has the advantage of reducing the freight, and, in many cases, import duties as well.

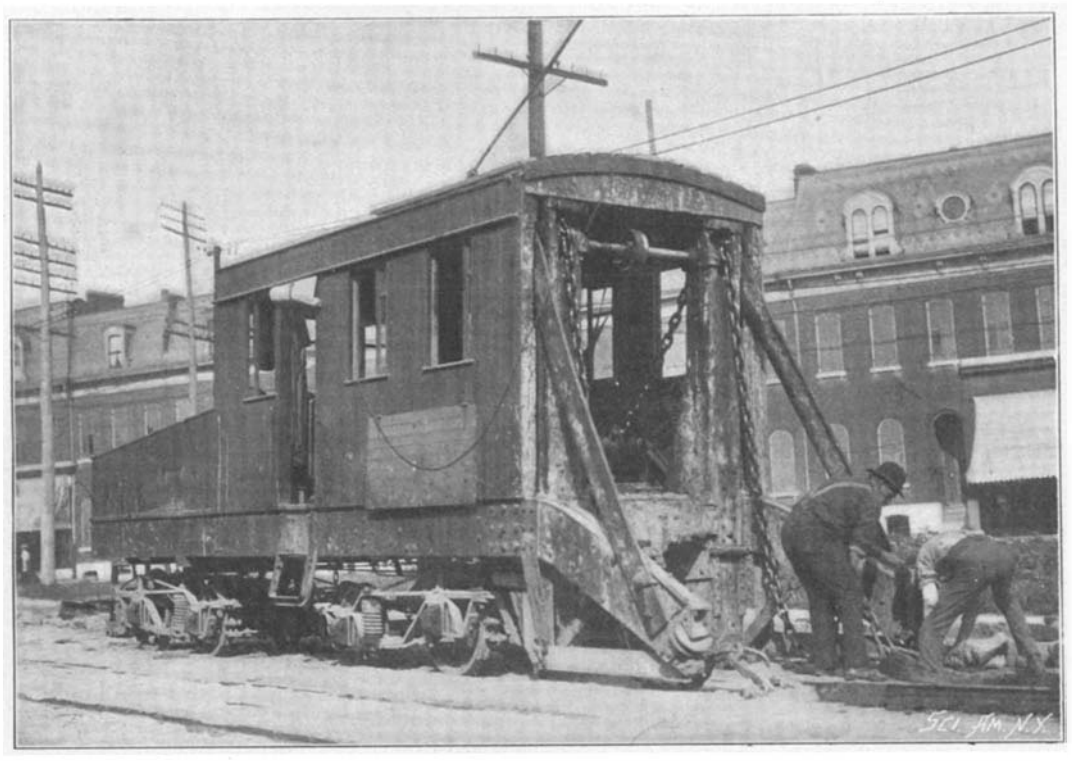
Cars sent to South America have been not only old-fashioned horse cars, but electric cars for a great variety of services. There has also been an outfit of meat cars and meat boxes, intended to handle the meat between the abattoirs and cold storage ships, as well as from the abattoirs to the city markets in Buenos Ayres. Another shipment of a number of cars was particularly interesting by reason of the fact that they were intended to transform the sleeping cars of the horse railroad into steam sleepers. The old line, some 100 miles in length, was operated by horses, and horse sleeping cars had been used for many years. These cars were taken from their wheels and mounted as a central section in the new car.

Central America and Mexico require a constant supply of cars of every variety. Some palace cars for narrow-gage steam roads, steam day coaches, freight cars, plantation cars, plantation electric locomotives, trolley cars of standard American types, and numerous special cars for street and steam railway work have been sent there. A few of these cars have been shipped entire, but the greater portion of them, after being completely erected in this country, are taken down and shipped in sections. Where the car is completely finished, men are often sent out to put them together upon their arrival. The cars sent to the city of Mexico, as well as those sent to South Africa, were erected by men who were sent from Philadelphia. The cars which are shipped "in the white," however, do not require special workmen to put them together, as there is no danger of injuring the sections during the work of erection.

Several peculiar types of cars are used in England. The favorite type is the ordinary double-deck car with the stairway at both ends. Large numbers of these have gone to the principal English towns. Municipal regulations both in England and on the Continent modify American designs most unfavorably, resulting in cars which are decidedly slow in operation. Glasgow has been experimenting with an American car which is carried on double trucks and which has a central entrance. Most of these have had one end devoted to smokers and open and the other end closed, as in American practice. The French car is usually a double-decker, often carried on a pair of Eureka maximum traction trucks. They have stairways at both ends and unusually long platforms.

One of the largest items of export has been that of trucks for electric cars. The Brills sent something like 2,000 of these abroad during the year 1899. In a single week orders were placed with these manufacturers for 1,700 trucks; one of these for 700 trucks is said to be the largest ever received in this country from abroad. The trucks are of three general types, the ordinary four-wheeled known as the No. 21 E, the maximum traction and a new form of equalized swing beam truck known by the firm designation as the No. 27. All these trucks have solid frames which may be either steel castings or solid forgings

The newly established car works at Preston, England, have not so far attempted to manufacture trucks, but are importing those of the Brill Company. Up to the present time the English and Continental railways have been content to use small cars mounted on four-wheel trucks, but there seems to be a marked change in their attitude, and recently a considerable number of double trucks have been ordered.



THE RAILBREAKER—ADJUSTING THE GRIPPERS TO THE RAIL.

Office Building Mail Service.

The large amount of mail matter which arrives at the New York Post Office every day addressed to the tall business blocks in Broadway and Park Row has caused the creation of what the postmen call "sky-scraper" mail routes, says The New York Tribune. They are considered quite a "cinch" for the winter, and the men who have been assigned to them are congratulating themselves that their work will be indoors. As many as three carriers have been assigned to some of the larger buildings, where the population is greater than that of many small towns and the mail matter received much greater in proportion. The Empire Building, American Tract Society Building, Park Row Building and Equitable Building have at least 3,000 occupants each, and have forces of mail carriers large enough for towns of that size. The daily population of the Equitable Building is 3,100, and three carriers work eight hours a day to handle the mail, which averages about eighteen thousand pieces a day. Every forty-five minutes mail wagons run over from the Post Office and carry back with them 75 pounds of outgoing mail. Many people who do not have regular offices in the building have their mail sent in care of friends, and this adds considerably to the quantity. The Park Row Building, with six floors given over to city departments, has an equally large mail. The Empire Building averages thirty-five thousand pieces a day, and there are several other buildings which receive almost as much.

The plan of making these big buildings separate delivery routes has given much satisfaction, and will be continued by the postal authorities.

Correspondence.

Galvanic Action of Copper Sheathing.

To the Editor of the Scientific American:

Apropos of article as above in issue of October 6, 1900, it is a matter of great surprise to me that the British Admiralty should not know of the dangers of the copper-steel sea-water combination. Years ago it was common practice to put copper strainers or bilge "strums" at the ends of the suction pipes of bilge pumps in wooden steamships. In course of time, when iron replaced wood in shipbuilding, the copper strainers were retained; several mysterious losses of ships at sea during fair weather occurred. One steamer went down at her moorings in the Mersey. When she was raised, it was found that there was a round hole in her bottom where the copper strainer had been. This led to investigation, and it was discovered that in many iron boats, where the inner coating of Portland cement (which is usually put in the bilges of iron and steel vessels) had been removed by any means, so that the copper strainer could rest directly upon the iron shell, the galvanic action had eaten the iron almost entirely through.

Lead strainers are now used, and lead bilge suction pipes to a great extent.

I was in an old boat, the "Memling," of Glasgow (subsequently lost on the African coast), that had a patch in the bilge plate where the copper strainer had been, and the old chief told me that when he discovered the weak place one day, when in port, he drove his machinist's hammer through it in testing the strength of the plates. E. A. Suverkrop.

Philadelphia, Pa., October 13, 1900.

Extending Applications of Alternating Machines.

BY ALTON D. ADAMS.

Alternating electric currents came first into general use for incandescent lighting at a distance. The comparatively low voltage of incandescent lamps, which during more than ten years remained at a maximum of about 125, was a strong incentive to the development of the high-pressure alternating system. With these lamps the direct system has an economic radius of distribution approximating one-quarter mile on the two-wire and one mile on the three-wire plan. Alternating dynamos of one thousand volts, as first introduced, raised the distribution limits, so far as mere weight of copper conductors is concerned, to sixteen miles from the central plant. As a matter of practice, the distance to which energy from the 1,000-volt alternators can be taken with profit is only a fraction of that for constant weight of primary conductors, because of the costs and losses in transformers and other items. Next in the important applications of alternating machinery was that for the long distance transmission of power. This was accomplished on a moderate scale, at pressures of several thousand volts, by the aid of synchronous motors, either with or without transformers. Some advantages existed in this plan over that for power transmission with direct currents, but a material drawback was the necessity for some external source of power to bring the speed of each motor up to synchronism with that of its generator before it would operate. Obvious advantages of alternating machinery for very high voltages and the transmission of power turned much attention to the development of a self-starting alternating motor. The desired result was achieved in the induction motor, adapted to operate on the two-phase or three-phase alternating system. It was soon recognized that the equipment just named is pre-eminent in its advantages for most cases of long distance transmission, and it was generally adopted.

In many instances energy is now being transmitted on the multiphase systems over distances under 50 miles and for a much smaller number of cases over distances of more than 100 miles. While the development of alternating apparatus for distant transmission purposes was going on, its application to the distribution of energy, for lighting and power, from central electric stations was rapidly being extended. The problems of transmission and distribution, now before many electric stations, involve higher voltages, great distances and enormous outputs. Meantime all of the requirements of consumption as to series arc circuits, low pressure supply and service to direct current motors remain. Above all is the desirability of uniformity, multiple operation and complete flexibility of each unit as to all of the load, at the last named plants. The multiphase system seems, by far, the best suited to meet these diverse requirements, and is already extensively applied for the purpose. Small, cumbersome and inefficient dynamos of the series type, for arc lamps, are being replaced by constant current transformers that take their energy from the large alternating generators and are used to supply the series lines. The same generators furnish energy at high pressure to circuits for incandescent lighting and motive power through transformers at considerable distances. Still other lines connect the main generating plant with as many substations as are desired. At these latter are located transformers and rotary converters that supply low-pressure direct current to thickly grouped consumers within a short radius. The diverse forms of electric energy thus delivered are all derived from the output at the main alternating generators. For such plants, the original voltage of 1,000 for alternators has usually been increased to over 6,000. Even in smaller systems, where the substation feature is omitted, the voltage of alternators has commonly risen to 2,000 or 3,000.

In plants of only moderate size the two and three phase alternators are now being installed in preference to those of single phase, because of the ease with which motive power as well as lighting can be distributed from the two former types. Such alternating equipment thus enables electric motors, series lines for street lighting and constant pressure service for incandescent lamps to be economically rendered by the same machines at a single station. During nearly fifteen years isolated electric plants were considered the peculiar and exclusive field for direct-current machines. The very extensive adoption of electric motive power in industrial works has done much to change the type of dynamo equipment in isolated plants from direct to alternating. Such changes have been particularly prominent in manufactories having long, heavy and uniform loads, such as textile mills. For these kinds of work all of the advantages of the induction motor, such as the absence of commutator and immunity from damage to working parts by grease and dirt, are available, while questions as to frequent stopping, starting and variable speeds do not have to be considered. At the present time, as during the past five years, the installation of alternating machinery for both light and power in certain kinds of industrial plants is going on at a rapid rate. The voltage of these isolated alternating plants is by no means uniform, nor is practice as to the use of transformers for the motors with them. In cases where steam power is used to drive the electric generators, pressures of 250 and of 500 volts have frequently been employed, and transformers between the dynamos and motors omitted. Water power at varying distances has been made available to drive the generators in other instances, so that comparatively high voltages were necessary for economy of conductors.

Those plants that combine transmission from a distance with power and light distribution in industrial works necessarily include transformers for the reduction of voltage at motors as well as at lamps. Perhaps the latest field entered by alternating equipment is that of distribution over a limited area, at low pressure, from a generating station whose circuits connect directly with lamps and other consuming apparatus at consumer's premises. Central stations of this class, like isolated plants, have been considered the especial province of direct-current dynamos. Several central stations are now in operation, however, that distribute energy from alternating generators, to moderate distances, without the intervention of transformers. Advantages claimed for the alternating over the direct current equipment, for this low pressure service, are those arising from the absence of commutators and a somewhat larger output per unit weight of material where multiphase apparatus is employed. Owing to the inability of alternating generators to regulate when connected on the three-wire system, these alternating stations at low pressure are limited to the maximum voltage of incandescent lamps, or about 250, on their lighting circuits. Since the inception of electric street railways, their generating plants have had distinct features as to voltage and type of equipment. A voltage of about 500 was early adopted and has since remained standard. Instead of the diversified equipment frequently found in the stations of systems for commercial light and power, street railway plants usually contain but a single type of dynamos, those for direct current output at 500 to 600 volts. As an alternating motor that is satisfactory for street railway service is not yet in sight, there seemed for a long time little opening for alternating dynamos in street railway plants, but this is now changed.

While the limits of single street railway systems have been constantly extending, the highest practicable voltage at the motors has remained at about 500. Such conditions have resulted in very large investments for line conductors, excessive line losses, and often in several generating stations for a single street railway system. A necessity has long been felt for a method of distribution between railway generators and car motors that would reduce the present number of generating plants, increase the size of the remainder, and cut down the costs and losses for line conductors. Alternating equipment has been selected to meet these requirements in a way similar to that by which it supplies low-pressure direct current for lighting and stationary motors. In a few of the more recent generating plants for street railways, and especially in one, the largest power station in the world, three-phase alternating dynamos deliver the electric energy at pressures as high as 6,000 volts. This high-pressure energy is transmitted to any desired number of points at suitable locations along the electric track system, and there changed to direct current at 500 volts by means of transformers and rotary converters. The high voltage at the main plant enables it to supply distant parts of a railway system at a small first cost and small subsequent loss for the conductor system. The small substations, delivering 500-volt current, give to the car motors the same form of energy they would receive if supplied from the usual type of street railway generators. One other important case in which alternating dynamos are being substituted for the purely direct-current type remains to be noted. Among the large class of low-pressure, direct-current stations that distribute energy for light and power on the three-wire system, there are many instances where tractive loads are presented beyond economic limits.

A similar condition exists in many electric railway systems, where much of the track is easily served from 500-volt generators, but a part is at a great disadvantage because of its distant location. For some of these cases double current generators have made it possible to supply both the near-by and the distant loads from the same machines. Double-current generators deliver both direct and alternating currents from the same armature windings, but to different circuits. The direct current flows with that from other machines, through the low-pressure system. The alternating current passes to station transformers, and the energy is thence delivered at high pressure on circuits that feed distant loads. When the current of high voltage reaches the place of use, it is received by transformers only for lighting, or by transformers and rotary converters for service to street railway motors or other direct-current apparatus. The brief glance just given to advances in the applications of alternating machinery shows that it has invaded most of the fields where the direct type seemed most secure. It is now a pertinent question whether the conquest is to be complete. By far the most important factors that have operated to make possible this great increase in the applications of alternating equipments are the induction motor and the rotary converter. Long distance transmission, and alternating-current distribution from central stations and in industrial works, for motive power purposes, depend to a very large extent on induction motors. Direct-current supply from alternating transmission lines, whether for general purposes or street car motors, is effected through rotary converters. It is notable that most extensions of alternating equipment have been made, not to supply new uses for electric energy, but as a means of economy in existing applications. It is to be remarked that while the alternating has in many instances taken the place of the direct type of generators, the direct-current form of energy continues to be delivered, to a large extent, at the points of use. This last is notably true for by far the great majority of electric motors supplied from central stations, whether for stationary or street railway purposes. Secondary batteries for the storage and regulation of electric energy can never come into immediate connection with alternating machinery. The current as delivered to or received from the batteries must in every case have a constant direction of flow. This last is also true in all of the growing applications of electric energy to chemical operations.

Successful Wood Sheathing.

Chief Naval Constructor Admiral Hichborn has submitted to the Navy Department a report on the "Bache," as to the utility of sheathing naval vessels. The Admiral's conclusions are as follows: To summarize, it may be stated that this vessel, not originally intended to be sheathed, was nine years after her launching fitted with a system of sheathing which involved a neglect of some of the most obvious precautions in such work. She served thirteen years continuously without an examination of or repairs to her sheathing or sheathing bolts, and is to-day in active service, though nearly thirty years old, with her frames and plates in such a condition, through internal corrosion in the machinery and bunker spaces, as would have long since compelled her abandonment or extensive rebuilding had she not been sheathed. That these results are possible under such conditions speaks volumes for the possibilities of an efficient system based upon experience (in which every precaution is taken and neutral non-corrosive naval brass bolts are employed), executed with scrupulous regard for the highest class of workmanship, in a service where periodical examination and proper care are fully provided for.

Statistics of Japan.

The following figures, taken from different official publications, will give an idea of the progress made by Japan in certain directions since 1890:

	1890	1898
Population	40,453,000	45,193,000
Commerce (taken for 1892 and 1898):		
Importations, yens	91.102,754	165,662.304
Exportations, "	71,326.079	276,996,526
Total, "	162,428,833	442,658,830
Production of silk, pounds	11,041,624	19,662,852
Production of tea, tons	26,274	34,428
Budget, expenses (1893-94 and 1898), yens	84,581,000	249,547,000

The value of the yen is about $0.50.

TWO INTERESTING USES OF INSECTS BY NATIVES IN NATAL.

BY DR. L. O. HOWARD, UNITED STATES DEPARTMENT OF AGRICULTURE.

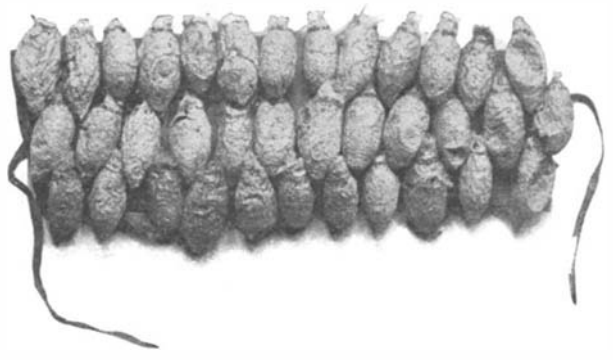
An entertaining volume could be written on the uses of insects by savage races. The writer has published some account of the uses of insects as food, in previous numbers of this journal, and the use of the wing-covers of certain large Buprestid beetles to decorate articles of clothing with South American Indians, the use of the structures made by termites as tinder in South Africa and other parts of the world, and many other uses, all well known to anthropologists.

The writer recently received from Mr. Claude Fuller, the Government Entomologist of Natal, two interesting anklets formed of the cocoons of a large Bombycid moth, somewhat resembling the Luna moth of this country and which bears the scientific name of Argema mimosae of Boisduval, known to the English residents as the Queen moth. The natives collect the cocoons after the moth has issued, put one or more small stones into each cocoon and sew them onto a broad strip of monkey skin, side by side, so as to cover the surface of the skin. They are sewn to the raw side of the hide, the fur being on the opposite side. The anklets received are 10 inches long by 4 inches wide and are attached to the strips by means of thongs of the same hide. The cocoons are tough and dry, and the stones within them rattle in a most delightful way. We give rattles to our children to amuse them, and the savage man has the same infantile characteristic in that he is amused by rattles. The use of these ankle rattles has become quite general in Natal since the introduction of the ricksha from China and India. The ricksha bearers wear the anklets very generally, and their rattle on the streets is almost as familiar as sleigh-bells in a New England town in winter.

This invention is not confined to southeast Africa. Dr. Walter Hough, of the United States National Museum, has shown me rattling anklets from Mexico which are made in a somewhat similar way, of the cocoons of another large Bombycid moth. In this case, very many cocoons are strung together on a string and several rows are tied around the ankle. Each cocoon has been opened for the purpose of inserting the stones. Dr. Hough also tells me of a much larger cocoon from India, which is mounted singly at the end of a stick to be carried in the hand. This cocoon also is made into a rattle.

The other use of the insect, or rather of the insect's product, is the rather well known one of the manufacture of the head-rings of the Zulus and Kaffirs. It is shown in the accompanying excellent picture, reproduced from a photograph for which the writer is also indebted to Mr. Fuller. This head-ring was early noticed by African explorers, and it was said to have been made of sinews surrounded with wax, massed on with the help of oil. The head is shaven, and some of the hair is worked up into the ring to hold it. As the hair grows, the ring is pushed up and must occasionally be reformed to some extent. This wax is said by Mr. Fuller to be the secretion of a scale insect of the genus Ceroplastes. I believe this fact has been recorded before, but I am unable to find the reference. These scale insects are extensive wax producers. The old Chinese white wax of commerce, for example, is secreted by Ceroplastes ceriferus. The exact species of Ceroplastes from which the Zulus get their wax is, I believe, not known. Prof. T. D. A. Cockerell, however, in The Entomologist for May, 1899, describes a new wax scale from West Africa as Ceroplastes egbarum, stating that this is a fine wax-producing species, equal in this respect to the Ceroplastes ceriferus, which produces the Indian white wax. It occurs upon the mimosa, near Abeokuta, the great city of Egbas, and was collected by Dr. H. Strachan.

ZULU WITH WAX HEAD-RING



COCOON ANKLETS FROM NATAL.

USE OF COCOON ANKLETS BY RICKSHA BOYS IN NATAL.

The Viagraph, an Instrument Devised for Measuring the Surfaces of Roads.

A few weeks ago we described in the SCIENTIFIC AMERICAN the "orograph," a device which measures and records the surface conditions of the road over which it travels. At the annual meeting of the British Association for the Advancement of Science recently held at Bradford, Mr. J. Brown, of Belfast (Ireland), gave a description of the "viagraph," an instrument designed for fulfilling the same purposes as the orograph. But though both apparatus perform the same work, their construction and principles of working are widely divergent. The viagraph consists essentially of a straight edge which is drawn over the road surface. To this straight edge a lever is attached working on a pivot, while on its free end it carries a serrated road wheel. As the straight edge is drawn along the road, it maintains a fairly even line, and the road wheel rises and falls over the slightest unevennesses of the surface of the road. These varying risings and fallings of the road wheel are recorded by means of a pencil, which works contemporaneously by means of a link and lever attachment, upon a roll of paper passing over a small drum. This drum is rotated by a worm and wheel fixed beneath it, and connected by means of a shaft and bevel gear with the road wheel, so that as the latter revolves it also serves to turn the drum. As the paper unwinds from the drum it passes under the pencil and is wound up on another drum. The pencil record upon the paper, which is somewhat similar to those made by the pencils of the barograph, is to full scale vertically and 1/8 to 1 foot longitudinally. Another pencil also draws upon this paper record, simultaneously with the profile pencil, another straight line which the indicating pencil would have drawn had the road over which the apparatus is at that moment traveling been perfectly level. By this means it is possible to obtain the exact characters and measurements of the unevennesses in the road's surface.

If the depths of all these unevennesses as recorded upon the diagram are totaled, the result is the numerical index of unevenness, and this is indicated upon a decimal counter. This latter instrument is actuated in the following manner: A cord is fastened to the free end of the lever attached to the straight edge, and is passed once round a double-grooved pulley and connected to a stretched rubber band. When the road wheel falls into a rut, the lever is depressed, causing the cord to rotate the pulley, the rubber band being stretched to permit the necessary movement to the cord. Directly the road wheel issues from the rut, the cord slips back into its former position on the pulley, the rubber band in contracting taking up the slack. The pulley is also braked by a rubber-tightened cord which is secured to a rigid part of the frame and passes round a separate groove on the pulley. By this means it will be recognized that the pulley only revolves at intervals in one direction—every time the road wheel drops—to an amount equal to the depths of all the unevennesses the machine has passed added together, and this sum indicated in inches on the decimal counter is the index of unevenness. If the road is a tolerably good one this machine will only record an unevenness corresponding to about 12 feet in the mile, while upon a bad road it will indicate an unevenness of 100 feet or more in the same distance.

A Recent Theory of Electricity.

An important development of the electron theory has been carried out by Robert Lang in his article on atomic magnetism in the Annalen der Physik (No. 7). It may now be said that the phenomena of magnetism have at last been successfully reduced to those of electricity. We know from the work of Thomson and of Drude that an electric current in a wire consists of a stream of very small particles called electrons. These electrons are formed by the splitting up of the metallic atoms into a larger positive and a smaller negative portion. The positive electrons, under the influence of an electromotive force, travel in one direction along the wire, with a velocity of one centimeter per second. The negative electrons travel in the opposite direction with the same charge, but with a smaller velocity. The masses are in the ratio of about 9 to 1. Now, according to Lang, the negative electrons revolve around the heavier positive electrons in a magnetized metal, like a planet around the sun, and the electric convection-currents thus produced are nothing more nor less than Ampère's "elementary molecular currents." Lang calculates the speed of the electrons and the diameter of their orbits. The speed is that of light, and the figures obtained lead to conclusions in close agreement with known facts.—Nature.

Annual Production of Rubber.

It has been estimated that the approximate total production of rubber annually is 57,500 tons. Of this amount, 21,000 tons are taken by the United States and Canada; 21,000 by the United Kingdom; and 15,500 by the rest of Europe. The Amazon district produces 25,000 tons, and East and West Africa 24,000 tons; parts of South America other than the Amazon district, 3,500 tons.

The Current Supplement.

The current SUPPLEMENT, No. 1295, has, among other articles, "Recent Street Railway Extension in Glasgow," by J. A. Stewart, and shows an excellent example of the good work which is being done in Great Britain toward furthering rapid transit. Prof. Chandler's exhaustive paper, "Chemical and Technical Education in the United States," is continued. "The First Two Trial Trips of Von Zeppelin's Airship" is illustrated from actual photographs showing the ship in its housing and its ascent. "Special Report on the Galveston Hurricane of September 8, 1900," is by Isaac M. Cline, Local Forecast Official and Section Director. "The Transportation Exhibit of the Paris Exposition" is accompanied by a number of illustrations showing parts of the centennial exhibit. "Curiosities in Clockwork" are also described. "The Age of the Earth," by Prof. W. J. Sollas, is continued. "French Cultivation with Chemical Manures" is an important technical article. "Morals and Manners of Japanese as Viewed by a Native" is an abridgment of an address delivered by Dr. Inazo Nitobe, of Sapporo, in Philadelphia and specially reported for the SCIENTIFIC AMERICAN SUPPLEMENT.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

GRAIN-DRILL.—Frank A. Placek, Milligan, Neb. The drill is designed to work equally well in hard, soft, trashy, or stubble ground. A sharp diamond-shaped runner is combined with the grain-tube. The runner clears the way for the shovel; the shovel opens the furrow; and the grain-tube delivers the seed into the furrow in two distinct parallel rows.

HARROW. — Hans H. Larsen, Campbell, Minn. The object of the invention is to improve harrows as regards the frame, teeth, and wheels or rollers, which are thrown down to elevate the teeth and support the harrow in traveling to and from the field. The parts are few in number, readily interchangeable, and are so arranged as effectively to brace the teeth. The form of the teeth makes them self-cleaning; and the novel mounting of the wheels, which are arranged in pairs on independent shafts to be separately rocked, facilitates the throwing down of the wheels and the raising of the frame by dividing the labor into two simple and easy operations.

WEED-CUTTER.—James McCorkell and Neil McEachern, Helix, Ore. The weed-cutter will also serve as a cultivator and will not clog. The construction is such that the blades or shares can be adjusted for effective work in all kinds of soil. The device automatically accommodates itself to any inequalities of surface and may be made in a group of independent sections.

Electrical Apparatus.

LIGHTNING-ARRESTER.—Charles M. Taylor, Georgetown, Ky. The object of the invention is to provide an arrester of simple construction which will carry off a lightning-current from telephone or telegraph line-wires, without grounding the line-wire. The lightning-arrester comprises vertically-extended grounding-plates insulated one from the other. A sleeve or collar holds the plates in their proper relation to one another. One of the plates is arranged in a frame of insulating material. The plates are electrically connected with a line-wire and with a grounding-wire.

TELEPHONE SWITCHBOARD, ANNUNCIATOR AND JACK.—Charles T. Mason, Sumter, S. C. The invention consists of a spring jack and indicating instrument or annunciator; springs and metal strips controlling the operator's talking and ringing circuits; and means for automatically restoring the annunciator or drop-shutter. All parts are operated by the application and adjustment of the plug. The object of the invention is to furnish a combination instrument capable of being adapted to any of the various arrangements of circuits which are assembled to constitute a telephone-exchange switchboard. The instrument embodies all the requisites of a metallic or single-circuit system.

ELECTRICAL RAILWAY.—James D. Robertson, La Salle, Ill. The invention is an improvement in electric railways, in which an electric supply-conductor is arranged in a conduit or between the track-rails, the object being to provide an electric railway which will be comparatively cheap to construct and maintain in order. A conductor for a heating medium is provided to prevent an accumulation of snow or ice around the distributing rails or cables. The heat conductor is so arranged that it may also be used to supply current to a car-motor.

Mechanical Devices.

WAVE AND TIDAL ENGINE. — Joseph J. McIntyre, Brooklyn, New York city. The invention provides a simple power device adapted to be placed upon or over a wharf and designed to be operated by the rise and fall of the tide. The machine is so constructed that the power derived from the rise and fall of the water will be multiplied and communicated to a shaft from which power may be taken. The machine may be connected with the deck of a boat or a float, so that the vessel may careen, rock, or toss without interrupting the operation of the machine and without injury to any of the parts.

Packing Appliances.

CUSHIONING-BODY.—Robert I. Stewart, Xenia, Ohio. This invention is an improvement in cushioning-bodies formed of corrugated sheets and adapted for use in egg-crates and in packing bottles and other fragile articles. The sheet is made so that its corrugations are held in the desired form. Such sheets, when formed of a number of layers, will not split.

WOODEN SHIPPING AND PACKING BOX. — Russell B. Fuller, Holland, Mich. It has been the inventor's object to devise a wooden shipping and packing box, designed for perishable goods and arranged to insure a perfect ventilation of the goods and to permit the convenient storing and packing of a large number of boxes in railroad-cars without the use of shelves and without danger of crushing the goods or injuring them by rough handling.

DEVICE FOR PACKING CIGARS.—Frank P. Folsom, Ashland, Neb. In a table or support a top plate is mounted to slide. Pivotally connected with the top plate is a bottom plate. Lever mechanism presses the plates together. A box of cigars is placed between the plates; and the cigars are pressed into the box by the two plates.

Vehicles and Accessories.

ICE-CYCLE. — Dietrich W. Tietjen, Milwaukee, Wis. The purpose of the invention is to provide an attachment for bicycles so that they can be employed on ice. To this end Mr. Tietjen employs detachable runners for raising the tires of the bicycle above the ice-rim for the rear or traction wheel of the bicycle, such rim being arranged to engage the ice in order to propel the bicycle.

FIFTH-WHEEL.—Monroe Hoagland, Henderson, Ky. The construction of this fifth-wheel is such that it can be placed rearwardly of the front axle, thus mounting the front axle so that the vehicle can be turned much shorter than would be possible were the center of movement coincident with the longitudinal line of the axle.

MOTOR-VEHICLE.—Avon M. Coburn, Daunt, Cal. The inventor mounts his engine horizontally and causes it to drive a power-shaft journaled in the middle of the vehicle below the seat. The power is transmitted by belt and pulley to an intermediate shaft and then by sprocket and chain to the rear axle. By this arrangement power is transmitted without jerk or jar to the driving-wheel.

VELOCIPEDE.—James Preston, Tuckahoe, N. Y. In this vehicle the driver's weight is used as a propelling power. The saddle is secured to a rocking frame which transmits its movement by a crank mechanism to the rear wheel of the bicycle. When the rider propels the wheel he obtains a very uniform and healthful exercise of the legs as well as of the body, owing to the alternate shifting of the weight from the seat to the pedals and *vice versa*.

BICYCLE.—Joseph P. Schooler, Grant's Pass, Ore. Lever-power is utilized in the form of a treadle to drive the ordinary form of safety-bicycle in such manner as to enable great force to be exerted and to secure a high speed with small expenditure of energy.

Miscellaneous Inventions.

SQUARE.—Armand P. Dubus, New Orleans, La. This square is adapted especially for marking key-ways on shafting. The square comprises a head having two straight edges at right angles to each other and provided with two legs at right angles to each other and with an aperture. In each straight edge is a spirit-level; and in the aperture of the head a spirit-level is adjustable. A scale slides in the head with its reading edge equidistant from the legs.

SPRING SHADE-ROLLER.—Edward C. Cordes, La Grange, Ill. The spring attachment for shade-rollers is so constructed that simplicity, durability, and economy are combined; that when the roller rotates, wabbling is prevented; and that the dogs ordinarily employed may be dispensed with in favor of more positive and quicker checks.

HOTEL-REGISTER.—John Bullock, Manvel, Cal. Mr. Bullock has invented a simple arrangement by which keepers of hotels and boarding-houses will be able correctly to prepare and preserve a record of the time their several guests or lodgers stay with them and of the number of meals taken, so that bills may be made out properly.

DINNER-PAIL.—May Welkee, Oakland, Cal. In order that the food may be heated before it is eaten, the pail is provided with a detachable bottom section carrying a heating device, preferably an alcohol lamp. Within the pail a water-pan is placed to be heated by the lamp, over which pan the vessel carrying the food is arranged. The top of the food-vessel is provided with compartments for liquids.

MEANS FOR DISCHARGING FIRE-EXTINGUISHING LIQUIDS THROUGH GAS-DISTRIBUTING PIPES.—Alexander Reid, Jersey City, N. J. The invention relates to a means for directing water or other fire-extinguishing liquid through the gas-pipes of a building. In case of fire, the water-pressure on being turned on, automatically cuts off the gas supply, leaving the gas-distributing pipes free to receive and discharge the extinguishing liquid into a room. Thus a fire-extinguishing system is provided at a small cost.

CURTAIN-POLE RING.—John Kroder, 268 Canal Street, Manhattan, New York city. Mr. Kroder has devised an improvement in curtain-pole rings having inside antifriction rollers adapted to travel on the pole. His ring is provided with recesses at the inside, into which recesses sockets are driven and held in place by frictional contact with the walls. A ball is held against displacement in each socket and is mounted to turn freely and to project beyond the inner side of the ring.

INCUBATOR. — John H. Hughes, Mianus, Conn. The heated fresh air, after passing through the egg-chamber, is carried from a foul-air chamber to discharge-chambers connected with the outer air by the pipe. Consequently a uniform and natural circulation of air is obtained without the slightest danger of the contact of foul air with the eggs. No dampers or other mechanical contrivances are required for regulating the air passing through the egg-chamber.

CUE-TIP FASTENER. — Romeo Ghezzi and Virginio Bianchi, Manhattan, New York city. The tip is provided with a spring-yielding loop which is inserted in the recessed head of the billiard-tip cue and held in place by frictional engagement with the walls of the recess. By this construction the tip can be readily attached to or detached from a cue.

SCHOOL DESK AND SEAT.—Paul S. McAulay and Martin Anderson, South Omaha, Neb. The invention relates to an improved form of desk and seat for schools, and consists in forming the end frames with sockets adapted to receive bars which respectively carry the seat and the desk. These bars are made independently adjustable, so that each may be moved to the height desired without affecting the other.

MEANS FOR FACILITATING HERMETIC SEALING OF TINS OR OTHER RECEPTACLES.—John R. Croft, 20 Mark Lane, London, England. This invention provides a simple means for sealing a tin can designed to contain food preserved without cooking, by exhausting the air and substituting an inert gas or melted fat. The invention consists of a means for effecting a preliminary sealing of the can and a final hermetic sealing. The preliminary sealing is accomplished by means of a bush or bung seated in the top of the vessel and provided with a straight passage and an oblique branch passage. A wooden plug is fitted in the straight passage and designed to close both passages. A final seal is applied after the plug has been driven in.

Designs.

CORN-CUTTING SCOOP.—Fred B. Crittenden, Brooklyn, New York city. The scoop consists essentially of a spoon provided with a row of triangular teeth.

CAMPAIGN BADGE.—Magne Forde, Osage, Iowa. The badge consists of two ox-eye daisies in which the bust pictures of McKinley and Roosevelt are inserted.

Note.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7976) A. K. D. asks: Have you any Supplements giving the reasons why a spark coil must be so to do its work, why so long, so thick, why such a sized wire, etc.? A. We have no Supplement giving reasons for the dimensions of a spark coil. These dimensions are determined by the object in view of the designer of the coil. This is primarily the largest possible number of amperes revolving around the iron core the largest number of times within a given space. To obtain the largest current, the resistance must be as low as possible; hence as large a wire as possible must be used. But if too large a wire is used, there will be too small a number of turns to magnetize the core strongly, or else the coil must be made very long, in order to get the desired number of turns upon it. The reason for all this is to obtain as large a self-induction as possible. On breaking the circuit, the current of self induction, or extra current, flows with the main current and aids in forming the spark. To balance up the various conflicting conditions, such coils are made eight or ten inches long and wound with No. 12 to 14 wire. The winding is usually not deeper than the thickness of the core. This practice is largely the result of experience on the part of the maker of spark coils, and gives good results.

(7977) A. S. L. asks: 1. What is the cause of the earth's magnetism and the shifting of the magnetic poles? A, Causes not known. You can find all that is known on this subject in Thomson's Electricity, price $1.40 by mail. 2. Where are the north and south magnetic poles situated? A. The north magnetic pole was found in 1831 in lat. 70° 5′ N. long. 96° 40′ W. in Boothia Felix, just within the Arctic Circle. The south magnetic pole has not been found. 3. How is it that the planets move in ellipses, instead of circles? A. The proof that the planets move in ellipses is mathematical, and was first shown by Kepler, who also proved that they did not move in circles. See some higher text book of astronomy.

(7978) O. P. A. asks: 1. In making a Holtz machine from directions in Supplement, Nos. 279 and 282, does it make any difference if the glass plates are slightly convex or bowed? I can't get any that are flat. A. Yes, a great difference. You cannot run a plate of glass which is not flat with any considerable speed without danger of breaking it from the centrifugal force, which tends to bring the plate in to one plane. 2. Can you tell me what is used to polish the sheet iron parts of new stoves? A. Sheet iron stove pipe is usually made of Russia iron, which is polished in the process of manufacture. See Scientific American Supplement, No. 966, on the "Manufacture of Russia Sheet Iron," 10 cents mailed. 3. I made a battery of a half gallon jar about 7 inches high, with a cylinder of copper in water and sulphate of copper for one element and a rod ¼ inch square of zinc in water slightly acidiferous in a porous cup about 2 inches in diameter and 6 inches high for the other; what was the reason I only got a weak current? A. The trouble with your battery is the small size of your zincs. It is a mistake to expect a piece of zinc ¼ inch square to do much work.

(7979) C. D. C. asks: 1. Why is it that the current from a battery, after passing through the primary coil of an induction coil, apparently becomes much stronger? A. The effect is due to the self-induction of the primary circuit. A current flowing through the turns of wire in a solenoid, such as the primary coil of an induction coil, induces a current in the turns of the secondary. It also induces a similar current in the turns of the primary coil, that is, in its own turns. When the circuit is closed at the vibrator or break circuit, the current of self-induction flows in a direction opposite to the primary current in the same coils, and thus reduces it. When the circuit is broken, the current of self-induction is in the same direction as the primary current, and reinforces the primary current. This is the course of the spark on breaking a circuit of a primary coil. The induced current is added to the primary. Spark coils work by this method, without any secondary coil at all. 2. In making drawings of machinery, how are the radii of the various curves found, so as to be drawn properly? A. The designer of a machine selects the curves he will use so as to have the machine strong and also present a neat and attractive appearance. Of course he knows the radii of the curve he has chosen. A draughtsman will have a number of rulers for the purpose of drawing curves, principally those for irregular curves. These can be purchased from dealers in drawing materials, and are known as "Irregular Curves." Then too there are flexible rulers, which can be bent so that the edge will pass through a series of points through which a curve must be drawn. The pencil will then follow the ruler and trace the curve desired. Thus the radii of the different sections of the curve need not be known.

(7980) G. R., Phila., writes: Please give me the correct method for applying temperature sag and pull corrections to chains and tapes. I have consulted several books in surveying, they all gave me the corrections, but not the method of applying them, i.e., which correction to make first, etc. A. The corrections can be made for temperature pull and sag in a tape and chain only from the known conditions under which it was tested. The expansion of a tape or chain should be deducted from the record for temperatures above the tested temperature, and added for temperatures below the test; for steel this should be 0 00763 of an inch in 100 feet for each degree Fah. variation above or below the test temperature. The sag and pull should be the same as given in the test. Any variation must be corrected by observation from trials from fixed measured points. The temperature correction should be first made. Sag and pull should be tabulated together.

(7981) W. C. W. asks how to restore dry batteries; how much acid and what kind of acid do you use, and do you close nail holes when charged? If so, with what? A. The method of restoring dry cells does not permit of their use as dry cells again. They are wet cells, in which the zinc of the former dry cell is the positive plate immersed in dilute acid, which penetrates the nail holes and comes in contact with the carbon inside the case. The acid should be sulphuric acid in 10 parts of water. The cell will work for quite awhile. This seems to be the best way to treat exhausted dry cells. Of course, the holes made by the nails are left open. The dish in which the cell is placed should be of glass, hard rubber, or of asphalted wood.

(7982) E. M. asks: 1. What will prevent the hard rubber end blocks of a spark coil from fading? A. We do not know how to keep hard rubber from deteriorating. Chemical action of the gases in the air ultimately ruins it. A coat of shellac will protect it. 2. What advantage, if any, would there be in winding a primary coil with two No. 15 wires instead of one No. 12 wire? Two wires being connected in multiple. A. There is no advantage in conductivity in using two No. 15 wires in place of one No. 12 wire, since the sectional area is almost exactly the same in each case. The two wires are easier to handle than the larger one. They will also radiate their heat more quickly, since they expose more surface than the one does for radiation.

(7983) W. B. asks: 1. How many grains of sperm the standard candle burns per hour? A. A standard candle is one that consumes 120 grains of spermaceti per hour, made six to the pound, and seven-eighths of an inch in diameter. 2. Where can sperm candles be obtained? A. They can be obtained from any dealer in physical apparatus. Paraffine candles do not give as much light for the same consumption of material.

(7984) D. D. asks: Will you please tell me the capacity in ampere hours per pound of the best storage batteries? A. A storage cell should give 2½ to 3 ampere hours per pound of charged cell, with an efficiency of about 85 per cent when discharged at a current density of 4·8 amperes per square foot of negative plate surface, reckoning both sides of the plates.

NEW BOOKS, ETC.

Analyses of Pig Iron. Collected and published by S. R. Church. San Francisco, Cal. Quarto. Pp. 173. Price $2.50.

The work comprises the analyses of pig iron made in the United States, Great Britain and other countries and also gives important statistics relating to the production. The collection of these analyses must have required a vast amount of labor. The publication of a portrait of the person to whom the book is dedicated is a decided novelty.

The Story of the Heavens. By Sir Robert S. Ball, LL.D., D.Sc. New York and London: Cassell & Company. 1900. 8vo. Pp. 568. Price $3.50.

This book is illustrated with twenty-four colored plates and numerous illustrations. The author is a well known astronomer, and he has produced a very readable book, which is not always the case with books on astronomical science. It is one of the best books which we could recommend for use in a library, and it will prove valuable to the beginner and the full-fledged astronomer as well. It has been vouchsafed to but few men to clothe scientific facts in such excellent English and in such a comprehensive manner as has Sir Robert.

Year Book of the School of Architecture of the University of Pennsylvania. Published by the Architectural Society. 1900. Quarto. Pp. 65.

The architectural course of the University of Pennsylvania is well known, and at the present time Philadelphia has become quite a center of architectural education. The designs given in the pamphlet are many of them excellent, and they are all beautifully reproduced.

Furniture Designing and Drafting. By Alvan Crocker Nye, Ph.B. New York: W. T. Comstock. 1900. Pp. 110, 21 plates. Price $2.

While there have been quite a number of books written upon cabinet making, and while we have splendid

volumes devoted to the historical side of furniture, we have never seen any book which goes into the question of the construction of furniture so thoroughly. The author is an instructor in furniture designing at Pratt Institute, Brooklyn, and his book shows that he has most excellent ideas regarding the building of furniture. The book is fairly well printed, the half-tones being specially good.

ENGLISH AND AMERICAN LATHES. By Joseph G. Horner, A.M.I.M.E. London: Whittaker & Company. New York: The Macmillan Company. 1900. Quarto. Pp. 166, 300 illustrations. Price $7.

The author states that the reason for the publication of this book is the growing importance of the American lathe trade in England, and the consequent interest with which the distinctive features of the lathes of both countries are regarded. The American lathe has now found its abiding place in large numbers in British service. It is gratifying to note that the American lathe has been received with such favor abroad. They are certainly magnificent specimens of machine tools. The present work deals with both English and American lathes; and special attention is paid to the internal construction. It is a book which will prove of great value to the mechanical engineer. It is excellently printed.

ONE THOUSAND OBJECTS FOR THE MICROSCOPE. With a Few Hints on Mounting. M. C. Cooke, M.A., LL.D., A.L.S. London and New York: Frederick Warne & Company. 1900. 16mo. Pp. 179, 12 plates. Price $1.

The earlier editions of this book are well known to microscopists, and the former editions consisted only of what is now Part II. The author has now introduced an introductory section dealing with the manipulation of microscopes, mounting of objects, etc. In its new form the book furnishes one of the simplest and best treatises for the beginner in microscopy. The plates, which are newly reproduced, are excellent. It is worthy of a large sale.

UP-TO-DATE DOMESTIC AND INDUSTRIAL APPLICATIONS OF ELECTRICITY. Popularly Explained. By Alpha. London: S. Rentell & Company, Limited. 1900. 16mo. Pp. 90.

F. BERGER'S FRENCH METHOD. (1900.) By François Berger. New York. 1900. Author's edition. 12mo. Pp. 190. Price 75 cents.

MÉLIE. By Jules Lemaître. Translated by François Berger. New York. 1900. Author's edition. 12mo.

In the preface to his book, the author has in no very gentle terms attacked his foremost competitors in his particular field. His accusations may or may not be well founded; at all events, they should find no place in the preface of a text-book. We can perhaps forgive M. Berger for this exhibition of bad taste; but his awkward rendering of Jules Lemaître's "Mélie" we cannot pardon. In the badly-mangled translation of this exquisite, pathetic little story, we find, besides numerous errors in English spelling, the following specimen of English impure and defiled: "From that day, every time they made 'a dish' at her house, she brought me some in a paper. She would draw it from her pocket with a mysterious air, but they were no more the potatoe sandwich! They were the victuals of poor folks, which smelt decidedly too strong. I tried to taste them, but they would not go."

THE SEPARATE SYSTEM OF SEWERAGE. Its Theory and Construction. By Cady Staley and George S. Pierson. New York: D. Van Nostrand Company. 1900. Third edition, revised and enlarged. 8vo. Pp. 324. Price $3.

The subject of the sewerage of towns is attracting more attention than formerly. Various plans have been employed, and many of them are objectionable. The moderate cost of the separate system makes it possible to carry out a system of sewerage in many cases where the expense of the combined system would make the construction of sewers impossible. The authors have produced an admirable book, which has stood the test of time, and which has proved very useful to sanitary engineers. It is a book which can be heartily recommended.

A TEXT BOOK OF MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN. By John S. Reid and David Reid. New York: John Wiley & Sons. 1900. 8vo. Pp. 389, 301 illustrations. Price $3.

The volume before us is one of the best we have ever seen on mechanical drawing. The illustrations are admirable and the methods for obtaining proportions, etc., are also extremely valuable. The principles of mechanical drawing are applied to the solution of practical problems in machine construction.

ENCYCLOPEDIA OF MEXICAN MINING LAW. A Digest of Mexican Mining Code. Also a Glossary of Mining Terms. By Richard E. Chism. City of Mexico. 1900. 18mo. Pp. 170. Price $2 in United States currency.

The mining laws of Mexico are complicated, and the author has done a signal service to all those who are engaged in any way in mining, in bringing together the various laws, etc., in alphabetical form. The work appears to have been excellently done, and the glossary of mining terms will prove very valuable.

AMERICAN FOUNDRY PRACTICE. By Thomas D. West. New York: John Wiley & Sons. 1900. 12mo. Pp. 408. Price $2.50.

The tenth edition of American Foundry Practice is now before us. It is an eminently practical book, and a large sale of a technical book of this kind is sufficient guarantee of its value. The latest American practice is described. It is filled with illustrations and tables.

THE KNIGHT OF THE GRIP. New York: David Williams Company. 1900. 16mo. Pp. 179. Price 60 cents.

The book comprises a series of papers relating to the personal methods and experience of the traveling salesman, and is reprinted from The Iron Age.

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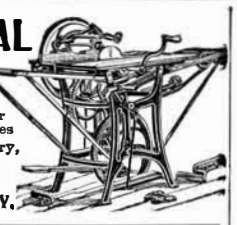

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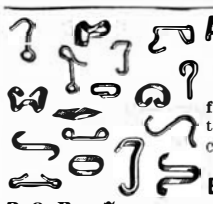

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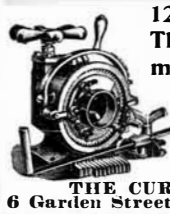

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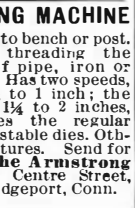

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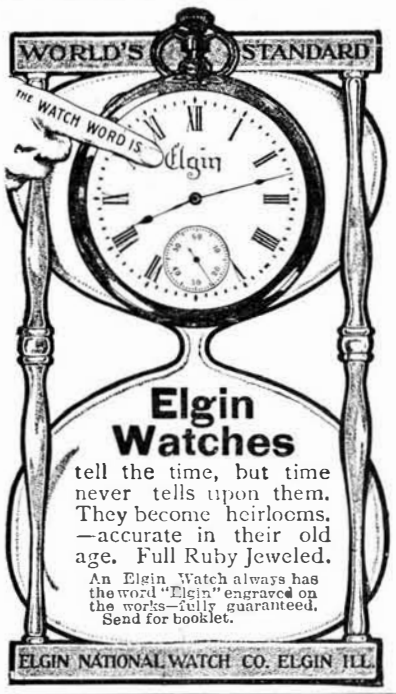

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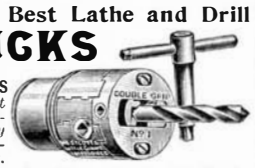

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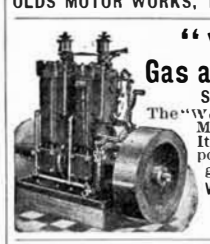

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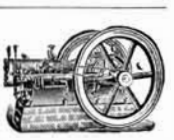

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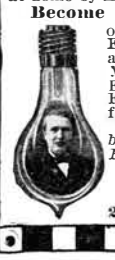

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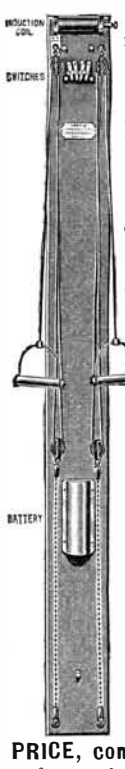

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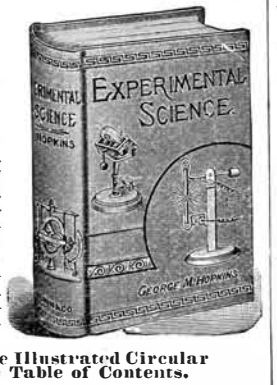

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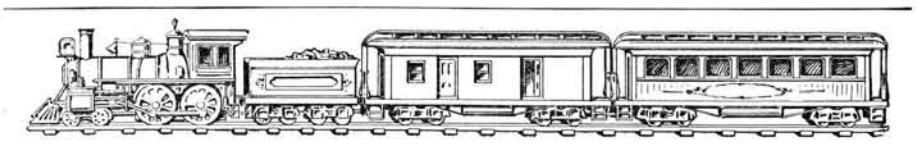

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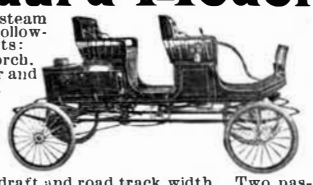

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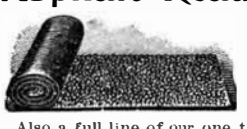

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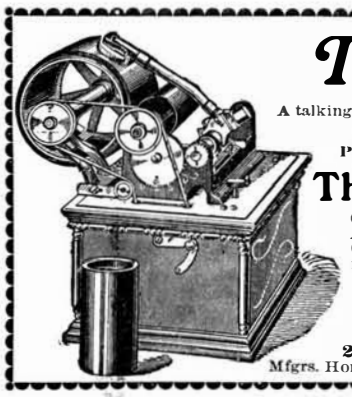

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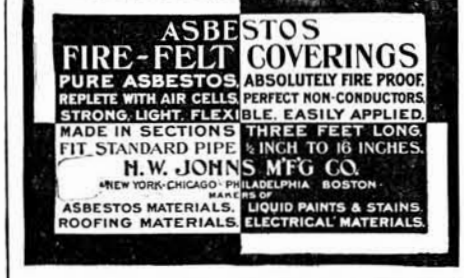

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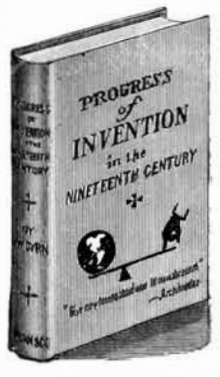

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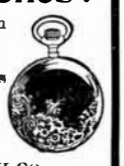

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